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Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

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INDIA

RESPONSIBILITY FOR NUCLEAR ARMING OF PAKISTAN ASSESSED

New Delhi PATRIOT in English 27 Feb 85 p 4

[Editorial]

[Text] When Pakistan acquires nuclear weapons capability--there is no if about it because all the indicators point inexorably to the creation of a nuclear weapon--several countries would have contributed to it. The Netherlands for being duped into taking in a Pakistani nuclear spy who fled with the secrets for the centrifugal method of uranium separation; the Swiss for supplying the equipment for pumping the gas in and out of the centrifuge; Canada for the machinery to spin the centrifuge at the desired speed and China for the design of nuclear warheads. All this has happened under the umbrella vigilance of the US which has, while paying lip service to nuclear non-proliferation, done precious little to stop its minions in Islamabad from pursuing a dream of having the bomb even, as the late Zulfikar Ali Bhutto put it, if Pakistanis had to eat grass for a thousand years. Without having to undergo any such rigour, thanks to the massive military and economic aid given by the US over the past six years, Pakistan is now on the verge of seeing the fruition of its dream. Reports indicate that the time is not far. The Israelis have computed that by 1986 Pakistan would be able to make 10 bombs equal in yield to those dropped over Hiroshima and Nagasaki by the US at the fag-end of World War II. Canadian police are believed to have unearthed records to show resemblance between the Pakistani nuclear programme and the US Manhattan Project which brought forth the first operational atomic bomb.

In the light of all this the revelation that the US has been soft on persons who have been caught red-handed for trying to acquire, on behalf of Pakistan, strategic equipment required mainly for the creation of a nuclear bomb is merely corroborative of the two-faced policy followed by Washington in this vital area. The offer of a nuclear umbrella to Pakistan made some time ago was more by way of making a gesture for public consumption than trying to stop Islamabad from pursuing its adventurist course. Pakistan has laid out a sophisticated network of agents in various countries to buy up equipment and despatch it home. If even in the face of evidence linking these agents to the Pakistan programme of nuclear weapons development the Governments of these countries treat their offences lightly, the conclusion is inescapable that there is an indirect nexus between Pakistan nuclear policy

and western strategic aims in this part of the world. The main concern is to ensure that the evidence does not lead directly to their own doorstep which is why the US moved to stop the export of nuclear triggers by Pakistani agents because such equipment is made only by US firms in the west.

As far as India is concerned, Prime Minister Rajiv Gandhi's statement that this country would have to review its policy if Pakistan made the bomb and created a strategic imbalance in the region indicates the depth of its predicament. Clearly we are being pushed to the wall and the Government cannot but be concerned at the failure of Pakistan's friends to dissuade it from a course of action that will only add to the prevailing instability in the region. A bomb, irrespective of whether it is tested or not, will unleash a chain reaction of political events, a preview of which is already before us in the developments in Punjab and Jammu and Kashmir.

CSO: 5250/0002

BULGARIA

PROGRESS REPORT ON CONSTRUCTION WORK AT KOZLODUY STATION

Sofia RABOTNICHESKO DELO in Bulgarian 1 Mar 85 pp 1, 2

/Article by RABOTNICHESKO DELO correspondent: "Hot Days at the Fifth Reactor"/

/Text/ Construction at the first 1,000 megawatt reactor outside the Soviet Union is making rapid progress near the shore of the Danube at Kozloduy. Over 6,000 people, with the most varied professions, 1,200 of whom are foreign specialists, are participating in raising up this unusual giant.

There are dozens of "hot" spots. Most of the people are working in or around the reactor section. Experienced brigades, who gained much valuable knowledge in the construction of the first four reactors, are participating in equipping the VVER-1000 power block. The work is extraordinarily responsible. Major block installation is being applied for the first time to construction, and it is not easy to bring together such a large (24 story) building as one whole construction unit.

The thousands of people working here are dedicated, and they have to overcome the wintry February, plus the icy Danubian cold. Installation of the lower block in the reactor's shaft and the laying of concrete are proceeding ahead of schedule, despite the complex conditions. The brigades and two-time hero of socialist labor Gospodin Yordanov, heroes of socialist labor Dimitur Petrov and Ivan Lichev, as well as order bearers Nikola Manasiev and Evgeni Yankov are distinguishing themselves by their mastery and courage in their work. The work completed on time now opens up new possibilities for taking the next hill.

The vitality in the machine hall is unusual: this is another extremely important site in the main building, the heart of the plant. Zlatko Stoyanov's people are attaining very good results. Men who have been facing the Danubian heat and cold for over 15 years are participating in the construction of the atomic power complex. The builders are overcoming many adversities and hardships, but the glass sections in the multistory machine hall were installed in time, and thanks to the help of other brigades the foundations were laid for the turbine.

The installation of the 1,000 megawatt turbine must start by 1 March. The fitters have given their word that they will finish in 1 year, and by doing so they will ensure the normal startup of the 1,000 megawatt reactor, during the second half of next year.

Each of the dozens of construction and installation organizations these days are taking additional measures to build the fifth power block on time. The representative of the Office of the Council of Ministers and the head of construction at the Atomic Power Plant, engineer Oved Tadzher, pointed out that in the near future another 1,200 people are coming to work here. Most impressive will be a group of 940 people involved in industrial construction. The managements of Montazhi and Khidrostroy will participate actively.

Forces are now being regrouped at the two key sites, the reactor section and the machine hall, in order to provide a broader front, even now during the early spring months, for installing the constantly increasing number of pieces of equipment which are coming here and which now weigh over 30,000 tons.

With every passing day the construction of the fifth reactor develops a broader front.

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ARGENTINA

BOIX AMAT VIEWS BUDGET CONSTRAINTS ON 1985 NUCLEAR PLAN

Buenos Aires INFORME INDUSTRIAL in Spanish Sep-Oct 84 pp 32-35

[Interview with Dr Raul A. Boix Amat, head of the Latin American Federation of Nuclear Associations and vice president of the Argentine Association of Nuclear Technology: "1985 Budget"; date and place not specified]

[Text] Dr Raul A. Boix Amat heads the Latin American Federation of Nuclear Associations and is vice president of the Argentine Association of Nuclear Technology.

INFORME ENERGETICO talked at length with this great expert on the evolution of the nuclear plan and its prospects. His philosophy is reflected in the answers that follow.

Boix Amat reflected: "It is obvious that in 1984 the nuclear plan is going through one of its most serious crises.

"This is not the first year that there have been difficulties nor will it probably be the last. However, if the intensity of these crises does not ease up next year, the country will definitely have compromised its nuclear future.

"The nuclear sector has had its budget most affected in 1984. In addition to the inadequate budget this year, there has been an inexplicable contraction in the flow of funds. This has caused delays in ongoing projects, increased costs due to unproductiveness and a serious debt by the CNEA [National Commission for Atomic Energy] to the private sector. This is transferring a financial burden to industry which will not be easily absorbed.

"Paradoxically, the sector has not slackened its efforts. The timely explanation by the government--calling the budget an instrument of transition--the national desire to pursue the development of peaceful nuclear applications expressed in Parliament, the political statement on this by the president of the republic and the firm conviction that the country cannot do without nuclear energy have preserved the hopes of the sector.

"Proof of this lies in the research and development carried out even during crises. This is demonstrated by more than 400 scientific and technical works developed during the year which will be presented at the 12th Scientific Meeting of the Argentine Association of Nuclear Technology.

"It should be explained that this research and development are motivated by large projects. If the nuclear plan is not reactivated, these activities will lose most of their raison d'etre."

INFORME ENERGETICO: Research and development are always a percentage of the profits of an enterprise.

Boix Amat: More than that, research and development are basic activities of the production process. It is impossible to conceive of research and development isolated from industry. It is equally impossible to conceive of an industrialist who does not need the resulting technology.

However, research and development rarely produce immediate benefits. Therefore, they can only be firmly undertaken when there is continuity in the development plans.

Without any question, the continuity of the nuclear plan was the main incentive for the technological development of the sector. It permitted development of a national technological infrastructure in this sector that only the central countries have. This gives Argentina obvious advantages in its foreign trade.

INFORME ENERGETICO: It should be recalled that the nuclear plan has not been stopped "dead" but is suffering an unfortunate "breakdown" that is now acquiring an institutional look because of budget cuts.

Boix Amat: Actually, development has been slowing down for some years now, partly due to the need to adapt to the economic growth of the country which did not meet initial expectations.

INFORME ENERGETICO: It is also true that the nuclear plan eventually absorbed higher percentages of the budget allocated to the development of the energy sector.

However, this is only part of the reality. The other part is related to our country's need to specialize in some sectors of economic activity. We have a certain capacity to manipulate modern technology advantageously compared to other countries with similar development but this cannot be discussed now. Doesn't the sector deserve any extraordinary resources like, perhaps, the sectors of information science or bioengineering require?

Boix Amat: I agree with you. Referring to the nuclear power plan which constitutes the main peaceful application of atomic energy, I have always given top priority to medium and long-range planning. Within this framework, the production forces of the country can fully develop their capacity. This means firm and realistic planning that is not subject to the vicissitudes of the budget situation. I am convinced that in order to end this crisis, Argentina must produce more with a higher added value. In other words, it must give priority to industrial production with high technological content. Although it will entail a big sacrifice because no country has achieved reconstruction without restricting consumption, this sacrifice will be futile if production

Raul Boix Amat

and investment are not encouraged and financial speculation discouraged. Argentina has a great need to increase its exports in order to fulfill its foreign commitments. It is true that it has traditionally resorted to agricultural and livestock exports for this....

INFORME ENERGETICO: The possibilities narrowed to the point of depending dangerously on a single market....

Boix Amat: There is the additional problem that all countries try to be self-sufficient in food and grant incentives and protection to their own agricultural and livestock producers.

INFORME ENERGETICO: And their stock. People in the EEC last year in Germany not only justified their protectionist attitude but further limited those markets based on statistics on their current food reserves.

Boix Amat: This reaffirms that the role that the central countries want Argentina to have as primary producer does not end because of the conditions under which the modern world develops. Through the nuclear plan, Argentina has developed a certain capacity to insert itself in the modern world, supplying goods and services with a high technological content. It is vitally important to preserve this policy, not only because of the inconsistency of the primary model but because the development of these industries will absorb more skilled manpower and will guarantee better living conditions.

INFORME ENERGETICO: There were some who thought Argentina could insert itself into the world of the future while looking back.

Boix Amat: And become a "banana country." However, Argentina has a population with a higher average level of education than the other countries with similar development. They will not accept a country model without projection toward modern industry.

As you indicated, the nuclear industry is one of the industries with advanced technology that should be promoted. There are solidly based reasons for this.

We know that in the next century, with other traditional resources exhausted, nuclear power which is perhaps the most spectacular peaceful application of nuclear energy will become the backbone of the electrical systems of many countries. Ours must turn to it heavily in the first decades of the next century.

We know that after 34 years of continued efforts in the nuclear sector, Argentina has managed to master a good part of the required technology. This grants it an important advantage compared to countries with similar development.

We know it is necessary to guarantee the continuity of industrial development in this sector, not only to amortize the investments already made but to establish the production capacity needed to meet both the internal and external demand for nuclear goods and services which will grow toward the end of the century.

We also know that these activities have a positive influence on the technological levels and quality of other industries. They permit the efficient use of the excellent human resources the country has.

With this knowledge, it would be incomprehensible to discontinue the nuclear power plan even if alternative sources of energy temporarily seem more advantageous.

INFORME ENERGETICO: Despite the conservationist currents and resistance movements observed in the highly technical world?

Boix Amat: No question about it. When the ecological impact of other sources is analyzed as thoroughly as nuclear energy has been analyzed, the latter shows definite advantages. In addition, the world cannot do without nuclear energy in the future. The alternative is a drastic reduction in consumption and strict control of the birth rate. In my opinion, the possibility of controlling social growth to that degree would require a very harsh system curtailing personal freedom. Since I believe that it is better to adopt intelligent solutions than repress freedom, I can predict that development will turn to an increasing use of nuclear energy in the next 50 years.

The central countries know this as do some peripheral countries that, like us, aspire to some autonomy in the world of the future. I think that, in this

sense, Argentina can do a lot for other countries with similar development. They are an important potential market for it.

INFORME ENERGETICO: Is the potential market exclusively Latin American?

Boix Amat: Absolutely not. The potential market for Argentine nuclear exports is basically all the peripheral countries. Naturally, there are ties with the Latin American countries that will make industrial complementation and the horizontal transfer of technology easier but the potential market for our nuclear exports goes beyond the regional framework. Perhaps I should even correct myself when I limit it to peripheral countries. We recently received an important delegation from China, a country with which we hope to be able to establish fruitful cooperation in the field of peaceful applications of nuclear energy.

INFORME ENERGETICO: What is our status with respect to Chinese nuclear development?

Boix Amat: Although China is one of the five world powers that have developed all the military capacities, it has advanced relatively little in the peaceful use of nuclear energy. There is a reason for this imbalance. It is much easier to mount a military program than a program for peaceful uses. The latter, in addition to the problems of the former, also involve criteria of economy and feasibility of investment that are normally minimized in military programs. In addition, civilian programs are usually more involved technically. In other words, it is easier and cheaper to generate plutonium for a bomb than for fuel in power reactors.

To separate plutonium for peaceful use requires more complex installations and more elaborate processes than for military use. I think Argentina is more advanced than China in this type of technology, in the technology of the treatment of waste and even in the field of nuclear powerplants. This does not minimize the fabulous potential of the People's Republic of China. However, our country has concentrated all its efforts for 34 years on peaceful applications, a road on which it perseveres, while China has concentrated on military applications. Therefore, it is natural that we can be proud of a relative advance in peaceful uses today. We believe it is possible to establish a good level of cooperation in this field. Given the magnitude of China's potential demand, it seems very attractive.

The same is true about other countries in the Third World that are not in the Latin American region. An interesting export promotion policy endorsed by the government is beginning to appear. This government support to promote nuclear exports clearly shows that there is no political decision to end the nuclear plan. It is a matter of adapting to the limitations imposed by the economic situation. I believe that the government understands the situation of the industry developed around the nuclear plan and is trying to give it as many opportunities as possible whether in the domestic market or abroad.

INFORME ENERGETICO: We have not ended the development cycle. For a long time, we must be recipients of technologies perfected elsewhere in addition to advancing our own adaptations and developments as much as possible.

Boix Amat: You are right. Therefore, it will be indispensable to ensure the continuity of the nuclear plan. Perhaps we should analyze the advantages of medium-power nuclear powerplants. This year the Secretariat for Energy Planning has made major efforts to reprogram the electrical equipment plans. Although the results of this reprogramming are not yet known, we do know that engineer Lapena understands that the importance of the continuity of the nuclear plan transcends energy aspects alone.

INFORME ENERGETICO: The entire development of the energy plan has been divorced from national reality and, consequently, so has the nuclear plan. The rest of the energy plans were discontinued a long time before the nuclear plan. Why? This is not my question but one that I have heard repeatedly from foreigners who do not understand the big difference between the economic change that has gone into effect and the reluctant continuation of some energy plans, especially nuclear ones.

Boix Amat: It is understandable that foreigners are suspicious. Argentina has not been known for seriously planning the medium and long-term development of any economic sector. The CNEA is a true exception. Nuclear development has continued for more than three decades and today, even during the crisis, the CNEA technicians are worrying about making projections that cover several decades in the next century. It is not easy for foreigners to understand this island of rationality in our country. Analyzing this uniqueness in depth, though, I believe the restrictions that were imposed on the free trade of nuclear technology forced the country to develop its own technology and its own industrial capacity for the first time. In this way, the production process was put together for the first time, tying research and development to the production of goods and services. Therefore, we can say that Argentina is a developed country in this field and is getting away from buying nuclear powerplants abroad in order to begin exporting them.

INFORME ENERGETICO: As to this possibility, would Argentina be competitive with the major producers?

Boix Amat: We think that Argentina can compete in some markets with the major world producers by the end of the century.

INFORME ENERGETICO: Despite the fact that one of the most serious problems that would have to be resolved--in the sale of nuclear powerplants--is financing?

Boix Amat: This is true. We feel that the countries that need to install energy sources in their territories to meet the needs of their people and their development will have to turn to international organizations to finance their equipment. At some point, hopefully, the international financial system will understand that the world cannot continue widening the large gaps that now exist. I think--and this is an opinion shared with many people--that toward the end of the century the technological gap between the semideveloped countries and the highly technical ones will be smaller. If this does not happen, the world will be very unstable.

INFORME ENERGETICO: I don't believe in the continual progress of the north and the continued delay of the south, either, but I also don't believe in the rationality of the centers of power.

Boix Amat: Nevertheless, I believe that the centers of power devote some effort to predicting the future. I think it does not escape them that the brutal differences today between the center and the periphery are not good for anyone. I believe that this type of thing cannot last much longer. Corrective measures will be put into effect. We are betting on the rationality of the world....Argentina is betting on a more equitable world.

INFORME ENERGETICO: It is a good bet.

Boix Amat: Otherwise, we would believe in the inevitability of major struggles and the hunger and poverty of the majority of mankind.

INFORME ENERGETICO: And suicide.

Boix Amat: Perhaps it is necessary to see that this is a possible line of evolution but we cannot bet the growth strategy of our country on this probability. It would not be ethical.

INFORME ENERGETICO: I fully agree. Months ago an official from an international organization came and, among other questions, inquired about the nuclear industry "lobby."

Boix Amat: "Lobby" is not an Argentine invention. I think that a number of different ideas, not always positive, can be included in that word. Perhaps it is appropriate to explain once more that the Argentine industrialists who invest and produce in this country, who create honest jobs and pay their taxes so that the state can reinvest them in projects for the general good, constitute an inseparable part of Argentina. This productive community which includes the labor force is the only reserve the country has to end its current economic crisis. An important part of this community has for years put all its efforts into the nuclear development of the country, convinced that the peaceful uses of atomic energy will benefit everyone. Naturally, this group of industrialists and workers who do not just belong to the private sector defend these activities and achievements as a genuine part of the national patrimony. If this group of Argentines constitutes a nuclear "lobby," I feel the country needs these "lobbies" in many other areas.

INFORME ENERGETICO: You depict an interest group. Is the nuclear industry a powerful pressure group?

Boix Amat: I don't think it is a pressure group but a group with clear convictions that tries to spread its way of thinking and its faith in the real possibilities of the country within the framework of the democracy we have achieved.

INFORME ENERGETICO: How many more delays will there be for Atucha II?

Boix Amat: Atucha II, according to the current plan, should begin operations in 1990. This date takes into account the delays in recent years and the assumption that the work rate will normalize in 1985. This assumes that the budget situation and the contraction in the flow of funds in 1984 will not be repeated in the future and that the CNEA will obtain a budget based on its needs.

INFORME ENERGETICO: Do you know if this budget will be kinder?

Boix Amat: That is indispensable. It must especially be counted on from the beginning of the year. If the 1984 situation is repeated, we will have seriously compromised more than three decades of continued efforts in this field.

INFORME ENERGETICO: At the end of last year--before the October elections--the secretary of energy then said that the next constitutional government was going to have to work for the first year with the budget drawn up by the military government. Although this statement seemed infuriating to me personally, that was how it was. The Chambers recently approved a rendering of accounts rather than the 1984 budget. If we had to work with the budget of the past year for most of 1984, it is possible that we will work with the 1984 budget for most of 1985.

Boix Amat: That can occur and would be unfortunate. The country would need another year to start up. It is not in the position to lose one more minute. I am referring to the productive country without diminishing the importance of what has been done institutionally this year. I believe that if the forces of production, including the nuclear industry, are not mobilized, the crisis will not ease up. The enterprises that exclusively produce nuclear goods and services will begin to disappear with the end of the nuclear plan.

INFORME ENERGETICO: Isn't reconversion possible?

Boix Amat: Engineer Agustin Rocca, founder of the TECHINT [expansion unknown] Group, said that the producer does not convert. He is born and dies a producer and his children remain devoted to the same industrial activity.

INFORME ENERGETICO: I fully agree but I was not referring to changing sectors but to changing from one industrial activity to another.

Boix Amat: It would be an enormous loss of effort, human resources and future possibilities. Nuclear technology has been the main factor of modernness in many of the industries. Our specialists will emigrate and we would irrevocably lose the comparative advantages in the international market achieved with great effort.

INFORME ENERGETICO: Finally, doctor, could you confirm that the nuclear plan has been a negotiating pawn during that interminable renegotiation of our foreign debt?

Boix Amat: I believe I have read all the publications and statements on that and the deep concern of the local press. Personally, I don't think it was.

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ARGENTINA

JORGE KITTL DISCUSSES FACTORS AFFECTING NUCLEAR EXPORTS

Buenos Aires INFORME INDUSTRIAL in Spanish Dec 84-Jan 85 pp 36-37

[Article by engineer Jorge Kittl: "Energy Planning and Nuclear Sector"]

[Text] The critical economic situation also affects the energy sector by producing a temporary energy surplus.

The change in demand, similar to what has happened in other countries, presents a challenge to energy planning. It must take into account not only a balance in supply and demand but also incorporate the hypothetical studies on the continuity of technological development and maintenance of the industrial capacity of the sector.

Under different circumstances, even in periods like between World War I and World War II, the country has seen how industries with an already developed capacity have disappeared. A few years later, this resulted in serious sectorial shortages. If all the projects that generate electrical energy bec e turn-key projects of international enterprises or consortia, decisions could be based on the best costs of generation. However, after promoting a capital goods industry in the electrical energy sector, the center of gravity changes and requires a careful sectorial study.

Industrial sectors are so sensitive to variations in demand that the depression resulting from a temporary situation can irreversibly affect sectors that could prosper and contribute to industrial production after that temporary situation is over. Due to its specialization, its limited activity and its few years of development, the nuclear sector is more sensitive than other sectors to changes in level of activity. In its favor is the fact that it operates with specialized technology that permits it to contribute to the manufacture of other capital goods.

In diversifying production, the nuclear sector has the alternative of reducing the levels of demand or applying them to nonnuclear products, paying the penalty in prices. Reducing the levels of demand will mean a later recovery. This is not minor and can present serious problems.

In general, when preparing an energy plan, the level of employment of the different sectors that supply energy must be kept in mind in addition to costs of

generation. The hydroelectric sector, for example, had to insure continuity in its projects so that there are no pronounced peaks or declines in employment. This policy would achieve stability in the sector and possibly a lower cost for the projects as a whole.

The procedure with the other sectors, including electrical distribution, must be similar. The global plan must pivot on maintenance of the capital goods production infrastructure and, in related cases, the fuel supply infrastructure.

The nuclear sector covers both activities: large projects and fuel supply. Large nuclear projects, particularly nuclear powerplants, require major construction, the manufacture of large parts, the supply of reliable auxiliary systems, specialized assembly, etc. Of all this, electromechanical supplies are the most sensitive. Even the assembly sector requires continuity. It is difficult to achieve a flow in the next 5 to 10 years that optimizes the sector and meets local electricity demands. Continuity must be insured so that activities are not irreversibly affected. After this period, facing a growth in demand, the needs in the area would negatively affect the foreign sector.

How to Achieve It?

There are at least two ways to solve the problem.

The first is to achieve that continuity through the nuclear projects in the country. The progress of Atucha II and the beginning of the fourth powerplant must be coordinated so that the beginning of the latter does not mean additional delays for Atucha II by establishing a competition between these projects for resources. Some nonnuclear projects in the energy sector would be added to the nuclear ones to achieve that minimal continuity. This must be done carefully since these other projects would help meet the demand for electricity and, consequently, compete with the nuclear supply. Therefore, there must be a balance between the continuity of the different sectors of electrical supply and optimization of the cost of generation in the sector as a whole.

The second way is the feasibility of exporting nuclear powerplants. This possibility requires a long-term analysis since the preparation and adaptation of technologies for that purpose would take about 10 years. This way must be followed carefully through an integration plan with the countries that might receive those exports. These exports depend, among other factors, on the capacity of the recipient country. The reactors will operate for many years in the recipient countries. Therefore, the technicians will be responsible for their correct functioning. The integration plan must contain elements from both the industrial sector as well as the educational sector of the recipient country. It must have a degree of feasibility that insures its continuity in time.

This way, export, seems attractive but it can only be taken as a long-term complement. It will not solve the situation of the next 5 to 10 years.

Jorge Kittl

The effort toward integration must be started well in advance. Therefore, it will require investments that will not be profitable at the national level for a long time. When presenting this alternative, there must be care that the planned exports do not differ from products of national consumption.

If installations were conceptually designed "for export" with no national basis, the problem of the sector would not be solved.

One possible solution to activate exports can be through association with other countries that supply nuclear powerplants. In this case, the experience

of those countries and their economic capacity can be complemented by Argentine experience to activate some sales. Time frames could be reduced and this could help resolve the temporary situation.

In addition to the construction of nuclear powerplants, it is important to consider the supply of fuels and related services known as the "fuel cycle."

The effort already made now requires investment consolidation. These are not significant compared to the installation of powerplants.

There is, however, a sector whose future escapes this analysis: uranium enrichment. It is unquestionably important to have a competitive technology since sales in the world market of "enrichment services" can help the foreign sector of the economy.

It must be considered that all the effort done in the sector to reach the proposed objective has a clearly measurable value in the international market based on the characteristics of the product.

One of the results of following this technology and achieving an industrial plant that functions efficiently and is competitive will be an alternative to the current line of reactors using natural uranium to generate energy. It is clear that levels of competitiveness are achieved after several years of operation. This has happened, for example, in the United States. Giving a vote of confidence to the group that has developed this technology would mean that this level of competitiveness will be achieved in some 3 to 5 years of operation. This would be one more achievement that the group would add to its already broad dossier.

In short, this is the time--in some 5 years--to begin to outline the features of a policy to apply this capacity so that the problems that concern us today, beginning with the foreign sector and continuing with the development of an industrial capacity with sustained growth, are resolved.

The different bills on nuclear legislation, including the Executive Branch's, not only contemplate the exclusive peaceful use of nuclear energy but also note the need to control the activity to insure fulfillment of the legal provisions.

Starting with this security, the use of enriched uranium--that will surely be low enrichment--can be tried in the existing pressure reactors and, in some 5 to 8 years, this experiment can improve the yield of these powerplants.

The possibility of turning to other types of reactors that use enriched uranium and that are suitable for the economic production of energy could be considered as an alternative.

Finally, we could provide enrichment to other countries like France and the United States, among others, do today.

This alternative--if we achieve adequate competitiveness--would mean entering a gigantic market offering only "added value" to a product. It starts with natural uranium which is processed. The client takes back his enriched material against payment for service.

What is collected is the "added value" to the product which consists of energy, amortization of investments and operating and maintenance expenses. All the factors mentioned are created or generated locally which makes this possibility very attractive.

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ARGENTINA

ENERGY UNDERSECRETARY LAPENA PROPOSES NUCLEAR PLAN REFORMS

Buenos Aires INFORME INDUSTRIAL in Spanish Dec 84-Jan 85 pp 26-30

[Interview with energy undersecretary Lapena; date and place not specified]

[Excerpt] INFORME ENERGETICO: The plan also talks about medium and short-range projects in the area of electronuclear power.

Lapena: We believe that the nuclear sector was conceived of strategically based on an energy viewpoint peculiar to the 1970's. The electronuclear powerplants should now compete with other possibilities and adapt themselves to the country left to us after the period 1976-83. We must reformulate the plans of the nuclear sector because it is no longer possible to talk about four more powerplants from Atucha II until the year 2000, much less four powerplants with 700 MW which does not coincide with the predicted demand.

We must put Atucha II and the heavy water plant that will supply Atucha II and Embalse--since its water must be returned--into service. Since it is necessary to permit continuity in industrial development plans, the idea is to have smaller powerplants until the year 2000. The fourth nuclear powerplant which will probably be built on the river or seacoast of our country will be defined in this way.

We think that the requirements for 1000 MW between 1995 and 2000--to respect continuity--could be divided by three powerplants. We are waiting for the opinion of the CNEA [National Commission for Atomic Energy], the organization that advises the political branch.

Although Argentina has carried out a serious effort in the nuclear field and is about to become one of the main producers of heavy water in the world, it is undeniable that the nuclear sector from now on must be reformulated. I believe we can sell electronuclear powerplants, parts, components, engineering, services, etc.

7717
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ARGENTINA

CNEA CHAIRMAN ON PROGRAM'S FINANCIAL PROBLEMS

PY090207 Buenos Aires NOTICIAS ARGENTINAS in Spanish 0030 GMT 8 Mar 85

[Text] Buenos Aires, 7 Mar (NA) -- Talking before the Chamber of Deputies Science and Technology Commission, Alberto Constantini, chairman of the National Atomic Energy Commission [CNEA], today said that the $420-million budget that has been allocated to the sector for 1985 "will not allow us to conclude the work plan at the Atucha II nuclear plant nor at the Arroyito heavy water plant." He harshly criticized the Finance Secretariat for making this decision.

Before the Radical Civic Union [UCR] and Peronist deputies who make up the commission, Constantini said that "the amount that has been allocated follows a rigid pattern established by the Energy Secretariat that calls for the Atucha II plant to be in operation by 1990." He warned that "we shall have to halt all research programs and work on the pilot plants, among them the production of cyclotrones." Moreover, the CNEA chairman complained that "last December the president approved a budget plan for nuclear activities, for which we requested $550 million, but Finance Secretariat officials have misinterpreted what was approved by the president."

He noted that "we shall have to stop all nuclear electrical activity, and this implies that we shall have to fire many physicists" involved in research work. He noted that "our budget is being discriminated against by the Finance Secretariat." He said that "we are led to believe that we are dealing with a group of ecologists" at the Finance Secretariat.

Constantini said that the budget will mean that we shall have to stop work on the Tander project (heavy iron engine) [acelerador de iones pesados], which will mean frustration for 100 physicists" and for "another group of physicists who are working at the Pilcaneyu uranium enrichment plant."

Constantini's explanation led the UCR and Justicialist legislators, among them the chairman of the Legislative Commission, Jorge Cheia, to express their intention to request information from the Finance Secretariat on the discrimination in the budget allocated to CNEA programs. Constantini noted that "we requested a special budget allocation for work to be developed in the uranium enrichment and reprocessing processes, but we did not get this amount. Since we have a pending contract, the CNEA is going to spend as much as if we were to work in this project."

He strongly questioned the policy being implemented by the Finance Secretariat by noting that "we are handling the financial situation very badly." He added that in view of delays in the work schedule, the Atucha II project will yield an economic loss because what Germany is doing at a cost of $1,000 per kilowatt, Argentina will do at a cost of $7,000. He also alleged "contradictions" [in the financial policy] because although "a presidential message on the budget calls for the termination of the heavy water plant, the Techint company is firing welders in the "heavy water plant because of the lack of government resources to pay them."

CSO: 5100/2030

BRIEFS

ZARACHO TO VISIT PRC--Buenos Aires, 21 Mar (EFE)--Adolfo Zaracho, Argentine Foreign Ministry general director for nuclear affairs and disarmament, has departed for a visit to the PRC to initiate negotiations for establishing bilateral cooperation for the peaceful use of nuclear technology. Although the PRC is one of the world powers that has atomic weapons, it is not advanced in the use of nuclear energy for domestic, peaceful purposes, such as producing electricity by nuclear plants, the reverse of the case of Argentina. [Text] [Madrid EFE in Spanish 1228 GMT 21 Mar 85]

NONPROLIFERATION ISSUE AIRED--(NA)--President Raul Alfonsin's government "is not attempting to replace" the Tlatelolco nuclear nonproliferation treaty with a Latin American multilateral accord, Foreign Ministry sources reported yesterday. The sources said the ministry made this clear to the United States Embassy last Thursday, when the U.S. science attache surnamed Whitman requested information on reports of a possible multilateral agreement. The sources added that neither nuclear disarmament nor Argentina's nuclear programme were on the agenda for next Tuesday's talks between President Raul Alfonsin and U.S. President Ronald Reagan. But the sources said Alfonsin would surely mention the Group of Six statement on disarmament issued earlier this year in New Delhi, while Reagan could bring up the Tlatelolco Treaty--which Argentina has not signed. Argentina agrees with the "spirit and the text" of the Tlatelolco Treaty, the sources, said, but not with the inspection of nuclear facilities stipulated by the agreement. The inspections are "discriminatory," the sources added, in that they do not guarantee that Argentina's industrial secrets will be kept. [Text] [Buenos Aires BUENOS AIRES HERALD in English 17 Mar 85 p 13]

OFFICIAL ON NUCLEAR PROJECTS--Regarding the nuclear plan, Lapena stated that it must go on. Atucha II must be ready by 1990. The construction of three other nuclear plants, with a total of up to 1,000 megawatts, will be considered, and their construction will begin progressively over the next 15 years. Each of these future power plants will have an output of 300 megawatts and their technical and industrial features, as well as cost, will make it easier to export similar units to other Third World countries. Lapena concluded by saying that this will make it possible to take advantage of the remarkable progress which the country has attained in the nuclear field so as to reap profits and strengthen the development of this industrial sector in which Argentina has attained special dynamism. [Excerpt] [Buenos Aires LA NACION in Spanish 19 Mar 85 p 13]

CSO: 5100/2030

SECTORS COMMENT ON CONTINUANCE OF FRG ACCORD, PROGRAM

Scientists Support Accord

Sao Paulo FOLHA DE SAO PAULO in Portuguese 9 Jan 85 p 6

[Article by Carlos de Oliveira: "Scientists Support Accord But Reject Nuclear Program"]

[Text] The decision to continue the nuclear accord between Brazil and the FRG, a generic nuclear cooperation agreement signed by the two countries in June of 1975, was probably the least important decision the probable future president could make in this sector. This intention was voiced the day before yesterday by the indirect candidate of the Democratic Alliance for the presidency of the Republic, Tancredo Neves, 74, in response to a question asked by a German television reporter. In reality, the main question is how the new Brazilian government will conduct the Brazilian nuclear program, which calls for the building by 1990 of eight 1300-megawatt atomic power plants, a uranium enrichment plant and other installations to enable Brazil to master the nuclear fuel cycle. The main thing is that for the time being, the program does not extend beyond the building of the Angra 2 and Angra 3 plants.

This is generally speaking the position defended by the scientists, who in the course of recent years have become harsh critics of the Brazilian nuclear program, especially because it has been implemented without consulting the domestic scientific community, the politicians or the nation as a whole. In any case, the second part of the statement by Tancredo Neves, to the effect that the agreement will be perfected and adapted to the conditions of economic and financial crisis in Brazil, was satisfactory, very much so, to physicists Jose Goldemberg, president of Sao Paulo Electric Powerplants, Inc. (CESP), Jose Zatz, Crodowaldo Pavan, president of the Brazilian Society for the Advancement of Science (SBPC), and the former industrial director of the NUCLEBRAS [Brazilian Nuclear Corporations, Inc.], Joaquim de Carvalho.

Distinction

In the view of Professor Goldemberg, it is necessary to make a distinction between the nuclear accords between Brazil and the FRG and the nuclear program agreed upon by NUCLEBRAS and the Kraftwerke Union (KWU), a German enterprise, for the construction of the plants. According to this physicist, "in stating that the Brazilian-FRG nuclear accord will be maintained, revised and improved,

candidate Tancredo Neves is doing the optimal thing, because revision of the program does not mean that the accord should be abandoned."

According to Goldemberg, "there is an agreement which is generic and diplomatic, calling for technical cooperation, and a NUCLEBRAS program with KWU calling for the installation of eight atomic power plants in Brazil. We take a position against the statement that in order for us to master atomic technology, we must necessarily purchase eight reactors. It is necessary then that we review the nuclear program and not the accord, which should be maintained in this search for technology abroad, including Germany." Revision of the Brazilian nuclear program, in Goldemberg's view, should basically involve abandonment of the plans to add other nuclear plants beyond Angra 2 and Angra 3.

Cancellation Disadvantageous

An identical view was expressed by physicist Jose Zatz, another critic of the nuclear program. In his opinion, the accord between Brazil and the FRG is like many other accords signed by Brazil in the most varied sectors of activity, and there is no reason to cancel it. "Our criticisms have to do with the nuclear programs, which are at the heart of this accord. I even believe that failure to continue the accord with the FRG would prove very negative for Brazil. It would seem too hostile to cancel a generic cooperation agreement between two countries. The interesting thing is that with the statement that the accord will be reviewed, we can perhaps have a broad discussion, particularly within the National Congress, of the future of this program, the number of plants to be built, the type and the time schedule for construction." Zatz also urges halting the nuclear program, for as long as the country needs, following the building of Angra 2 and Angra 3. It is worth noting that the Angra 1 plant, the only one partially functioning, is not a part of the NUCLEBRAS-KWU program, and thus the accord between Brazil and the FRG.

Contracts

In the view of Professor Crodowaldo Pavan, president of the SBPC, "rejecting the agreement (accord) with the FRG is one thing, and accepting a slowed-down version of it, taking from it the good things and excluding what is not of interest, is another. The statement by Tancredo Neves is somewhat generic, but even so, the SBPC has taken a firm position on the matter. No one opposes the accord, for the problem is the contract to be signed as a function of it."

In the view of former NUCLEBRAS director Joaquim de Carvalho, "there is no reason to change the accord between Brazil and the FRG. It is a question of a long-term commitment which does not go into detail but merely establishes the intention of the two governments to cooperate in the nuclear sector. What can be discussed is the haste seen in the implementation of the accord on the part of the NUCLEBRAS and KWU, which like any other commercial enterprise, wants to sell its products."

Things Are Not What They Seem

In the final analysis, what is the nuclear accord? For 7 or 8 years the people of Brazil have heard resounding criticism of the Brazilian-FRG nuclear accord from the domestic scientific community. And today there are many who support the accord and are focusing their criticisms on "certain contracts signed between NUCLEBRAS and the Kraftwerke Union." Are these contracts not the direct product of the accord? And why should the nomenclature used for so many years be changed at the last moment? Could it be only because the probable future president of the republic has revealed the most unexpected and worrisome tolerance for the accord? It must not be forgotten that the people of Brazil responded positively to an appeal from the Brazilian scientific community, placing blind trust in it, and demanding in addition that the party favored with their votes, the PMDB [Brazilian Democratic Movement Party], include in its program a clear condemnation of the nuclear accord. An abuse of semantics and retreat from the positions achieved thanks to such discussion and effort at understanding will be a great disappointment to the people.

Press Release

The following is the text released day before yesterday by the press advisers to Tancredo Neves.

Tancredo Neves Will Continue Nuclear Accords (Brasilia)--The nuclear accords signed with the FRG will be continued, maintained and improved, although in some cases they need to be "adapted" to Brazilian economic conditions, Tancredo Neves informed German television correspondents yesterday (07), explaining that it is not the intention of the Brazilian government to cancel the nuclear accords.

The Democratic Alliance candidate referred yesterday to the need for a period for organizing the government, "which is not an easy task in a country as large as Brazil and with its political complexities."

At the conclusion of the press conference, the candidate said, in answer to a question as to whether there will always be democracy in the country: "This is our intention and our desire. I believe that those familiar with the experience Brazil and Argentina have had in the past 20 years will never want to go back."

Press Office
Tancredo Neves
Democratic Alliance Candidate

Statement by Ulysses Guimaraes

(Brasilia)--Ulysses Guimaraes, president of the PMDB, said yesterday that at the meeting he and the indirect candidate of the Democratic Alliance, Tancredo Neves, had with former German chancellor Willy Brandt, president of the Socialist International, in July of last year, the matter of the "Brazilian-FRG nuclear accord" was discussed. "On that occasion," Ulysses Guimaraes

recalled, "Tancredo's position was the same as today. In the short talk they had, he set forth his position to the former chancellor: he accepted the accord, provided adjustments were made."

Ulysses Guimaraes pointed out that former chancellor Willy Brandt does not represent the present government of the FRG. However, he played an important role in the signing of the cooperation treaty between the two countries, "because he was prime minister of the FRG at the time."

The PMDB leader in the chamber, Freitas Nobre, believes that the nine nuclear plants for which the original project calls, "are too many." He would prefer that the two under construction be completed, and he urges modernization of the technology.

Burden on the Nation

The independent candidate of the PMDB for the presidency of the Chamber, Deputy Alencar Furtado of Parana, regards the Brazilian-FRG nuclear accord as burdensome for the country. Speaking of the position adopted by Tancredo Neves on the matter, he said that "according to the technicians, Brazil, just as much as Iran, which has the same type of accord with Germany, has served the Germans as a guinea pig.

"Iran cancelled the accord, but Brazil submitted to its technological terms in costly fashion, which is the reason for the need to revise its norms."

Error

PMDB Deputy Fernando Santana of Bahia thinks that "the accord contained only one serious error: its dimensions are too great and it did not have the cooperation of the domestic scientific community.

"We would never have any way to acquire complete mastery of the atom through the United States," Santana added. "In this connection, therefore, this accord destroyed a blockade, although Brazil was unable to profit from the potential thereof."

Self-Appointed Judge

Another PMDB deputy quite close to Tancredo Neves, Cid Carvalho of Maranhao, said that "the Democratic Alliance candidate, in making conditions about the accord as he did, set himself up as a judge, with the support of Brazilian public opinion.

"It seems to me that Tancredo made a restrictive but consistent condition, with a view to adapting the accord to our reality."

PMDB Deputy Iraja Rodrigues of Rio Grande do Sul, one of those responsible for the drafting and channeling of the PMDB recommendations to the probable future president, stressed that "in speaking about an adjustment of the accord to our national realities, Tancredo Neves practically placed it in quarantine.

"When the time comes to review the agreement in the light of these interests," he stressed, "I am certain that Tancredo Neves will discuss the matter with the politicians,and all segments of Brazilian society should participate in this debate."

Neves Approach

The PDS [Social Democratic Party] candidate to head the government in Rio de Janeiro, Wellington Moreira Franco, has termed "the position of Tancredo Neves with regard to the nuclear accord quite correct."

"It is basic," he said, "that this agreement, from the point of view of planning investment, be adapted to Brazil's situation. Thus the accord should be revised with a view to adaptation to a realistic public expenditure policy. In Brazil, the government is the largest investor, but despite this, it is private business which creates more jobs. It will be necessary for the government to reduce its expenditures and to encourage the private sector. It will probably be to this guideline that the Brazilian-FRG accord will have to be adapted."

Revision

PMDB Deputy Jorge Uequed of Rio Grande do Sul proposes that the Brazilian nuclear project be discontinued because he thinks that the national economy could not support the expenditures resulting from it. "It is not the president of the republic, but the Congress, which must decide this matter. The accord should not be renewed simply to please General Geisel, who launched it."

PMDB Document on Accord

(Brasilia)--If the draft PMDB government program is adopted, probable future president Tancredo Neves will have to undertake a revision of the nuclear accord with the FRG. The document entitled "A New Republic," which was delivered to the candidate yesterday, suggests in connection with nuclear energy that the future government undertake an "institutional reorganization of the sector, to establish precisely the functions of all the bodies involved in the program."

"The deputies believe," the document goes on to say, "that the NUCLEBRAS structure needs to be reduced such as to make it more compact, and that greater participation in the nuclear program by private business should be encouraged, even exploring the possibility of making some sectors private."

Governor Montoro Voices Views

The Brazilian-FRG accord calling for the peaceful development and use of nuclear energy should be revised, Sao Paulo Governor Franco Montoro, 68, said yesterday through his press adviser, Tao Gomes Pinto. He was referring to the statements made to German newsmen last Monday by the candidate of the liberal alliance, Tancredo Neves, 74, indicating that if elected president of the republic, he will revise this accord.

Vice Governor Orestes Quercia, 46, said that "the accords signed by the Brazilian government with other nations must be honored if the nation is not to lose its credibility." But he noted that "the revision of the nuclear accord with Germany is essential, because we continue to believe that nine nuclear plants are too many for a country with as great a hydroelectric potential as ours, and that they represent a program which will still further burden our already weakened economy."

Quercia recalled that the PMDB "opposes the accord signed with the FRG, but it understands that Tancredo Neves cannot simply revoke it, and thus must revise it, in order to reduce the volume of the projects for which it calls."

"Green" Deputy Condemns Accord

The continuation of the nuclear accord between Brazil and the FRG which the probable future president of Brazil, Tancredo Neves, has promised, even if adapted "to the Brazilian situation of economic and financial crisis," reflects "a realistic assessment of the balance of forces electing him to office," in the opinion of Deputy Willi Hoss, 55, a member of the Green Party of the FRG. However, Hoss does not believe this is the best solution to the nuclear problem.

As a representative of his party in the group of seven German parliamentarians which arrived in Brazil 2 days ago, Willi Hoss noted that the Brazilian-FRG nuclear accord was only possible thanks "to the interest of German multinational countries operating in this sector at that time." He added that members of the Green Party reject the accord because they believe that its goals are not very clear even in the country of origin, the FRG, insofar as there has as yet been no explanation as to what will be done with atomic waste. "We do not like this type of transfer of technology, above all to a country like Brazil."

Revision Poses No Threat

In the view of Deputy Nefi Tales, 46, who is president of the Sao Paulo Legislative Assembly, "this accord should be studied rather carefully, although former president Ernesto Geisel has supported candidate Tancredo Neves. The nation must not be threatened."

Wagner Ross, PMDB leader in the Sao Paulo Legislative Assembly, 42, believes that "the nuclear accord was established at a time of false economic euphoria and under the influence of growing militarism, and it does not serve the most important interests of the Brazilian nation. The statement by Tancredo Neves is cautious, but I am certain that the studies he will order made after he takes office will point to elimination of or drastic reduction in the nuclear program."

Fauze Carlos, 64, PDS leader in the Sao Paulo Legislative Assembly, said: "If he is going to continue the accord, he should know why he is doing it, also taking the opinion of the experts in the field into account."

Pinguelli Rosa Urges Cancellation

(Rio de Janeiro)--The statements made by Democratic Alliance candidate Tancredo Neves, 74, concerning continuation of the nuclear accord with the FRG were criticized by physicist and former president of the National Association of University Teachers (ANDES), Luiz Pinguelli Rosa, 42. He stated that the scientific community is urging cancellation of the accord "because it is harmful to the national interests."

Pinguelli proposes a revision of Brazilian energy, and in particular, nuclear, policy, "which is too grandiose and is an unnecessary and abusive burden for the country." He believes that the Brazilian-FRG accord and all the enterprises established in relation to it should be discontinued. "At the most, the agreements on the completion of the Angra dos Reis power plant, which is in its final stages, should be carried out."

This physicist also regards a redefinition of the functions of NUCLEBRAS as essential. He urges the conversion of this body into an energy engineering and equipment enterprise adapted to a nuclear policy of the dimensions needed by the country. "The technical and human potential should be channeled toward this goal," he said.

Pinguelli also criticized the process of enriching uranium by means of a centrifugal jet which was imported from Germany and "never worked properly," and the pursuit of a parallel enrichment program controlled by the military. "Military participation reflects the warlike purpose and encourages the atomic race between Brazil and Argentina which is already under way."

National Interest Should Prevail

(Brasilia)--Jose Serra, the coordinator of the Tancredo Neves Government Planning Commission (COPAG), has stated that the nuclear accord between Brazil and the FRG "is being analyzed by the commission and will be assessed in the light of the national interests." He was commenting on the statements made by the Democratic Alliance candidate for the presidency to the effect that the treaty should be maintained by the next government, but can be improved.

The majority of the members of the COPAG consulted by FOLHA yesterday preferred not to comment on the statements about the nuclear program made by Tancredo Neves, all of them saying that they had not yet read the interview with the candidate. Former minister Helio Beltrao dismissed every reference to the interview, stating that "I did not read it, I did not see it, and I cannot comment."

Speaking in the same tone, economist Cristovam Buarque said that he would neither support nor condemn the statements by Tancredo Neves. "Ask Renato Archer or Prof Jose Goldemberg, who are involved in this sector. I only saw the headline and I have not yet read the text."

Prof Celso Furtado, like the candidate, urged continuation of the accord provided it is revised in terms of adaptation to domestic conditions. "Personally, I am in favor of revising the program. The scientific community,"

Furtado went on to say, "has recommended and urged a reassessment of the accord. And I believe that the statements by candidate Tancredo Neves in this connection have been dictated by the same line of reasoning."

Businessman Sergio Quintela, in turn, said that "the program was signed between the two countries. I believe that the statement by Tancredo Neves should be situated within his plans for the scientific and technological sector. I would rather not comment on them."

In the view of economist Luciano Coutinho, the time schedule for the implementation of the nuclear program has in practice already been revised several times, and is today practically at a halt. Concerning the statements made by Tancredo Neves, Coutinho also preferred not to comment, stating that he had not yet read FOLHA.

Further Opinions

Sao Paulo FOLHA DE SAO PAULO in Portuguese 10 Jan 85 p 7

(Rio de Janeiro)--Nuclear physicist Enio Candotti, 42, who is editor of the SBPC journal CIENCIA HOJE, said he was "very surprised" by the statements made by Tancredo Neves to German television reporters to the effect that he will continue the nuclear accord. Candotti believes that the public "has already violated and buried the accord" and there is thus no reason to "revive a ghost."

Candotti said that "in the past 10 years, the scientific community has voiced criticisms of the nuclear accord and program which proved right, as for example when we warned that there would be no transfer of technology. The nuclear accord and program are bankrupt and should be canceled by the new government, after discussion in the National Congress, which should serve as a forum for debate on the issue."

After condemning the use of nuclear energy for war purposes, Candotti proposed that if the suspicions that there is a parallel nuclear program for the production of an atomic bomb by Brazil are confirmed, nuclear energy too should come under the control of Congress, which, if possible, should put an end to this.

Engineer David Simon, who is regarded in scientific circles as the "father of Angra 1," also opposes continuation of the nuclear accord. He is critical of the position adopted by the president of the CESP, Jose Goldemberg, who urges continuation of the accord and elimination of the nuclear program. Simon noted that the "two things" are inseparable, "because the accord calls for a program of nuclear plant construction." He proposes that the accord be reviewed, and that an agreement be reached with the FRG to suspend it until it is adapted to the energy needs of the country. "For the present, building power plants in addition to Angra 2 and Angra 3, which have already been commissioned, is unnecessary," Simon says.

Energy Minister Favors Treaty

(Brasilia)--Minister of Mines and Energy Cesar Cals, 58, said yesterday that the next government cannot fail to continue to implement the Brazilian nuclear program, because "the construction of nuclear plants will be necessary if a nuclear industry is to be established in the country."

Commenting on the statements made by presidential candidate Tancredo Neves concerning the continuation of the nuclear accord with the FRG, but with some adjustments, Minister Cesar Cals said that an adaptation of the treaty to the Brazilian reality was previously attempted, when the nuclear plant construction schedule was extended in order to facilitate the mastery of technology. "Nuclear technology today has been mastered, because with the plant being built in Rezende, in Rio de Janeiro, the viability of the most delicate aspect, the enrichment of uranium, has now been demonstrated," Cesar Cals said. He announced that President Figueiredo is scheduled to visit the installations in February.

All that is lacking for complete mastery of the nuclear fuel cycle, according to Cesar Cals, is the construction of reprocessing units, which in his view are not needed now (because there is nothing to reprocess). In addition, the reprocessing technology is not a basic point in the Brazilian nuclear program. According to Cals, contract arrangements for four more nuclear power plants, out of the eight for which the accord signed with the FRG calls, remain to be made, but this will be preceded by the soliciting of international bids, giving priority for purchase to the FRG, if the terms are desirable.

Professor Recommends Shutdown

Prof Luis Carlos Menezes, 41, a physicist at Sao Paulo University (USP), yesterday urged the immediate shutdown of the Brazilian nuclear program "so that not a single further useless nickel will be spent and so that the entire nation, especially the National Congress, can think and decide what the interests of the country in terms of nuclear energy really are."

This scientist also warned of the danger of "a certain play of words" seeking to suggest differences between the Brazilian FRG nuclear accord, which is a cooperation agreement between the two countries of a generic and diplomatic sort signed in 1975, and the Brazilian nuclear program, which calls for the building of eight atomic power plants in the country.

According to this physicist, who has already participated in work groups affiliated with the PT [Workers Party], the nuclear accord and the nuclear program became a part of the same thing in the end, since the accord, although it is a cooperation agreement like many others signed by Brazil, "serves as a frame in which the trade agreements fit." Among these agreements is that between NUCLEBRAS and the German Kraftwerke Union enterprise.

In this connection, Menezes stressed that the statement made 2 days ago by the indirect Democratic Alliance candidate for the presidency of the Republic,

Tancredo Neves, 74, to the effect that he will continue the nuclear accord between Brazil and the FRG if he is elected president, is of little importance in view of the complexity of the nuclear program resulting from it.

5157
CSO: 5100/2072

BRAZIL

TEXT OF NUCLEBRAS ANNUAL REPORT FOR 1984

Brasilia CORREIO BRAZILIENSE in Portuguese 22 Feb 85 pp 10-11

[Text] Ministry of Mines and Energy: Annual Report of Activities of the Brazilian Nuclear Corporation (NUCLEBRAS) for 1984; C.G.C. No 00,322,818/0001-20.

Gentlemen Stockholders:

Created on 16 December 1974 for the purpose of establishing nuclear technology in the country, NUCLEBRAS has responded, within the context of the responsibilities that pertain to it as part of the Brazilian nuclear program, to the government's decision to place Brazil among the nations that develop and apply nuclear energy solely for peaceful purposes.

To fulfill its objectives, NUCLEBRAS acts: as the agency for the absorption of technology in the area of process, basic design and manufacture of components; as the agency for the transfer of technology in the area of detail design, product engineering and the manufacture of equipment and materials and as the agency for industrial promotion, by the placement of orders and the introduction of strict quality control and guarantee requirements.

Despite the shortage of funds, the external pressures due to strategic, political and commercial reasons and a certain internal resistance inherent in every process of technological innovation, today the Brazilian nuclear program is an indisputable fact.

Within that context, NUCLEBRAS is responsible for the following principal activities: the exploration and mining of uranium and associated minerals; the establishment in the country of a heavy industry for the manufacture of reactor components and an industry embracing all stages of the nuclear fuel cycle; the promotion and development of nuclear engineering and its assimilation by national private companies; and the management of the construction of nuclear-electric power stations. Its major lines of action, therefore, are the design and construction of power stations, the fuel cycle and technological qualification based on a structure that will enable it to seek its own solutions or those adapted to the peculiarities of the country's development.

Continuity of the Brazilian nuclear program, with appropriate adjustments as to size--according to electric energy supply requirements and taking into

account the need to complete the transfer, absorption and establishment of nuclear technology--therefore, is essential in order that the country may be in a position to utilize with technological independence all the forms of energy it may be able to produce itself.

In the course of 1984, despite all the difficulties faced by the company and its subsidiaries, the results achieved demonstrate the high technical standard of its teams, the effort carried out to fulfill the established program and, above all, the constant dedication of all those who constitute the real technological patrimony of the company and the country.

Among those results, NUCLEBRAS notes the following:

--the signing of contracts with PETROFERTIL and Andrade Gutierrez Construction for execution of the first phases of installation of the Itataia and Lagoa Real mining-industrial complexes for the production of uranium concentrates, consisting of the technical and economic feasibility study and the installation of the pilot-plants;

--field prospecting work that resulted in the identification of a mineral anomaly in the southern part of the state of Para with characteristics that indicate the existence of a deposit of appreciable extent and high degree of uranium content;

--the production of 138 tons of uranium concentrate ("yellow-cake") is the Pocos de Caldas Plateau mining-industrial complex;

--the production of heavy minerals by the Nuclebras Monazite and Associated Minerals Corporation (NUCLEMON) obtained from the treatment of monazitic sands, primarily: monazite, zirconite, ilmenite, rutile, rare earth salts and salts of sodium, lithium and thorium;

--the completion of assembly of the first uranium isotope enrichment cascade at the Resende industrial complex and the beginning of tests of the equipment and integrated systems that will enable the cascade to go into operation in the first half of 1985 and, consequently, the beginning of isotopic separation by the centrifugal-jet process;

--the transfer to Brazil of all the heavy equipment for the Angra-II and III nuclear-electric plants that was stored in the Federal Republic of Germany;

--the construction of the mole protecting the channel of the water intakes of the Angra-I, II and III plants;

--pouring of 26,554 cubic meters of concrete for Angra-II, that project having reached a completion level of 62 percent of the civil construction, 50 percent of the assembly of the containment sphere and 80 percent of the detail design engineering, making it possible to schedule the beginning of installation of the electromechanical equipment for the end of 1985;

--the excavation of the foundations of Angra-III in order to insure the pouring of the leveling concrete beginning in April 1985;

--the construction of the building of the nuclear power station operation simulator and the beginning of the transfer of that equipment from Germany--where it had been operating since 1982--to Brazil, to train the operators of Angra-II and III;

--obtaining foreign financing in the amount of $353.5 million, as approved by the Planning Secretariat (SEPLAN).

The board of directors of NUCLEBRAS takes this opportunity to express its respectful thanks to His Excellancy President Joao Baptista da Oliveira Figueiredo, his excellency the minister of mines and energy, Senator Cesar Cals de Oliveira Filho, the country's senior government officials, as well as the company's fiscal council for the confidence and constant support received.

The Executive Board of Directors: president, Dario Jose Goncalves Gomes; directors: Jose Pinto de Araujo Rabello, Ney Freire de Oliveira Junior, Ilmar Penna Marinho Junior, Wenceslau D'Avila Fernandes Magalhaes, Paulo Lima.

Patrimonial Balance

Assets

(in 1,000 cruzeiros)

	On 31 December	
Current	1984	1983
Cash and banks	277,433	721,110
Financial applications	13,213,603	19,545,158
Accounts receivable	18,062,405	718,161
Committed deposits-Central Bank (BACEN)	197,632,376	3,764,473
Recoverable costs of services and equipment underway	244,415,809	75,815,439
Subsidiary companies	35,140,808	19,452,422
Others	5,516,818	4,165,886
Stocks	113,318,364	70,567,821
Expenses of next fiscal year	14,296,371	1,995,881
	641,873,987	196,746,341
Long-Term Receivable		
Advance to suppliers	26,921,673	9,764,330
Subidiary companies	499,667,199	146,342,231
Recoverable costs of services and equipment underway	9,797,597	4,325,452
Advance for future capital increase	44,035,238	1,935,732
Financing granted	4,971,652,815	1,294,618,885
Others	2,130,803	614,279
	5,554,205,325	1,487,600,909
Permanent		
Investments	399,757,848	102,190,009
Fixed	405,204,806	75,352,069
Deferred	815,783,261	164,546,248
	1,620,745,915	342,088,326
	7,816,825,227	2,026,435,576

Patrimonial Balance

Liabilities

(in 1,000 cruzeiros)

On 31 December

Current	1984	1983
Suppliers (subsidiaries, 656,587 cruzeiros in 1984 and 658,861 cruzeiros in 1983)	108,048,453	96,586,111
Financing and loans	438,177,116	115,323,601
Salaries and social charges	24,712,773	1,532,799
Provision for income tax	91,719,692	16,200,890
Others	-	139,901
	1,173,906	341,175
	663,831,940	230,124,477
Long-Term Payable		
Suppliers	93,602,080	30,318,984
Financing and loans	5,984,237,570	1,400,326,717
Subsidiary companies	2,844,206	3,871,410
Federal credit for future capital increase	367,782,295	83,825,831
	6,448,466,151	1,578,342,942
Result of Future Fiscal Years		
Revenues of future fiscal years	639,558,532	215,325,952
Minus costs and expenses pertaining to revenues	603,827,039	202,238,006
	35,731,493	13,087,946
Net Patrimony		
Authorized capital	365,511,153	117,192,105
Minus capital to be subscribed	67,015,755	21,378,767
Subscribed and integrated capital	298,495,398	95,813,338
Capital reserve	1,014,556,532	268,179,278
Accrued losses	(644,256,287)	(159,112,405)
	668,795,643	204,880,211
	7,816,825,227	2,026,435,576

The explanatory notes are an integral part of the financial statements.

Executive Board of Directors: president, Dario Jose Goncalves Gomes, CPF: 000,583,516-04; director-superintendent, Jose Pinto de Araujo Rabello, CPF: 290,227,387-87; directors: Paulo Lima, CPF: 010,024,497-15; Ney Freire de Oliveira Junior, CPF: 006,428,783-20; Ilmar Penna Marinho Junior, CPF: 021,253,317-72; Wenceslau D'Avila Fernandes Magalhaes, CPF: 289,326,687-87; accounting department: accountant, Alex Borges Barreto, CRC-RJ-46,679-9-S-DF -533; CPF: 363,500,367-00

Statement of Changes in New Patrimony

	Capital Reserves				(in 1,000 cruzeiros)
	Capital	Monetary correction of capital	Other monetary corrections	Subsidies for investments	Legal
Balances on 31 Dec 1982	87,671,029	7,859,332	15,446	44,771,269	23,787
Adjustments of previous fiscal years	-	-	-	-	-
Funds for application in investments	-	-	-	1,736,065	-
Compensation with cost of the specific project	-	-	-	(351,520)	-
Integration of capital	403,539	-	-	-	-
Capital increase according to AGO of 20/4/83	7,738,770	(7,738,770)	-	-	-
Monetary correction	-	149,965,314	24,177	71,897,965	37,245
Net loss for period	-	-	-	-	-
Absorption of part of loss	-	-	-	-	(61,032)
Balances on 31 Dec 1983	95,813,338	150,085,876	39,623	118,053,779	-
Integration of capital	76,650,670	-	-	-	-
Capital increase according to AGO of 27/4/84	126,031,390	(126,031,390)	-	-	-
Monetary correction	-	618,303,679	85,285	254,144,588	-
Net loss for fiscal year	-	-	-	-	-
Absorption of part of accrued losses	-	-	(124,908)	-	-
Balances on 31 Dec 1984	298,495,398	642,358,165	-	372,198,367	-

Statement of Changes in New Patrimony

	Profit Reserves			(in 1,000 cruzeiros)
	Nuclear Technology Development Programs	Special Investments in Subsidiaries and Associate	Accrued Profits (Losses)	Total
Balances on 31 Dec 1982	23,399	242,292	(20,163,324)	120,450,230
Adjustments of previous fiscal years	-	-	8,234	8,234
Funds for application in investments	-	-	-	1,736,065
Compensation with cost of the specific project	-	-	-	(351,520)
Integration of capital	-	-	-	403,539
Capital increase according to AGO of 20/4/83	-	-	-	-
Monetary correction	36,638	390,338	(31,558,587)	190,793,090
Net loss for period	-	-	(108,159,427)	(108,159,427)
Absorption of part of loss	(60,037)	(639,630)	760,699	-
Balances on 31 Dec 1983	-	-	(159,112,405)	204,880,211
Integration of capital	-	-	-	76,650,670
Capital increase according to AGO of 27,4/84	-	-	-	-
Monetary correction	-	-	(342,535,037)	529,998,515
Net loss for fiscal year	-	-	(142,733,753)	(142,733,753)
Absorption of part of accrued losses	-	-	124,908	-
Balances on 31 December 1984	-	-	(644,256,287)	668,795,643

Statement of Result

	(in 1,000 cruzeiros) Fiscal Year Ending 31 December 1984	1983 (reclassified)
Gross revenue from sales of goods and services	12,018,120	5,669,498
Minus returns, rebates, taxes and assessments on sales and services	1,703,488	823,869
Net revenue of sales of goods and services	10,314,632	4,845,629
Costs of goods and services sold	10,812,345	4,714,956
Gross operational profits (losses)	(497,713)	130,673
Operational expenses (revenues)		
General and administrative: (including salaries of administrators: 169,909 cruzeiros in 1984 and 68,224 in 1983)	139,054,660	46,873,495
Financial (deducted from expenses, 3,467,946,183 cruzeiros in 1984 and 233,061,937 cruzeiros in 1983)	(537,303,049)	(273,963,273)
Prospecting and exploration	18,636,492	7,422,344
	(379,611,897)	(219,667,434)
	379,114,184	219,798,107
Net loss from participation in subsidiary	60,452,010	37,166,451
Net operational profit	318,662,174	182,631,656
Net nonoperational revenues (expenses)	(8,681,630)	(3,000,698)
	309,980,544	179,630,958
Monetary correction of balance		
Of net patrimony	(529,998,515)	(190,793,090)
Of permanent assets	1,052,043,110	190,793,090
	522,044,595	-
Monetary variations from financing for fixed assets	1,138,169,602	322,025,525
	(616,125,007)	(322,025,525)
Loss before special item	(306,144,463)	(142,394,567)
Special item	163,410,710	-
Loss before income tax	(142,733,753)	142,394,567)
Income tax	-	34,235,140
Net loss for fiscal year	(142,733,753)	(108,159,427)
Loss per share	4.30	5.87

The explanatory notes are an integral part of the financial statements.

Statement of Sources and Applications of Funds

(in 1,000 cruzeiros)

Sources:	Fiscal Year Ending 31 December 1984	1983
From stockholders:		
Federal credits for future capital increase	165,249,999	78,467,489
Integration of capital	637	403,538
From third parties:		
Transfer of fixed and deferred to current assets	11,825,161	4,001,233
Subsidies for investment	-	1,736,065
Increase of long-term financing	1,292,623,789	256,841,556
Foreign suppliers	18,265,170	14,784,119
Others	-	78,047
Total of sources	1,487,964,756	356,312,047
Applications:		
In operations:		
Net loss for fiscal year	142,733,753	108,159,427
Minus charges that do not represent outflow: of funds		
Decrease of permanent assets	10,750,452	156,673
Depreciations and amortizations	85,679,892	29,305,037
Monetary variations on long-term debt	3,631,098,028	948,730,759
Net loss in participation in subsidiaries	4,390,539	1,145,707
Plus revenues that do not represent inflow of funds	59,011,125	36,215,460
Income tax	-	34,235,140
Charges on financing granted to Furnas Electric Power Stations Corporation	3,401,133,364	948,698,479
Monetary variations from transactions with subsidiaries	360,848,363	109,861,860
Debit result of monetary correction	685,455,305	-
Monetary variations from advances for future capital increase	55,310,038	21,350,328
Others	18,007,813	216,335
	872,558,600	206,967,933
In the permanent assets:		
Acquisition of assets from the fixed assets	17,380,379	8,435,569
Increase of the deferred assets	27,195,577	16,143,125
Increase of investments	217,485	245,383
	44,793,441	24,824,077
For other purposes:		
Increase of transactions with companies of the group	86,505,071	13,668,436
Increase of advances for future capital increase	1,695,959	2,653,835
Financing granted	253,257,019	42,090,851
Transfer of long-term obligations to short term	217,068,428	45,959,950
Others	666,055	-
Total of applications	559,192,532	104,373,072
Increase (Reduction) of Net Current Capital	1,476,544,573	336,165,082
	11,420,183	20,146,965

	Balances on			Variation to	
	31/12/84	31/12/83	31/12/82	31/1284	31/12/83
Current Assets	641,873,987	196,746,341	37,547,807	445,127,646	159,198,534
Current Liabilities	663,831,940	230,124,477	91,072,908	433,707,463	139,051,569
	(21,957,953)	(33,378,136)	(53,525,101)	11,420,183	20,146,965

Explanatory Notes to Financial Statements

Note 1. Activities:

The Brazilian Nuclear Corporation (NUCLEBRAS) is a joint-economy corporation formed as the executing agency of the federal government's monopoly in the nuclear energy sector, the principal activities of which are mineral prospecting and exploration, the production of uranium concentrate, the development and installation of the conversion unit, the manufacture of the fuel element, the development of the reprocessing unit, the supplying of assets and equipment for the construction of nuclear-electric plants and the financing of construction of those plants.

Note 2. Principal Accounting Practices:

a) The result is determined by the system of fiscal year accountability, thus, including:

--the revenues earned in the period, and the corresponding costs, charges and expenses incurred, independent of their actual receipt or payment;

--the net effects of the monetary correction of the permanent assets and the net patrimony and of the monetary or foreign exchange variations, at official indices and rates, applicable to current and long-term assets and liabilities;

--the charges corresponding to deprediation of the fixed assets and amortization of the deferred;

--the losses derived from participation in the subsidiary companies.

b) The assets receivable and liabilities payable for a period of up to 360 days are classified as current.

c) The fees derived from irregular transactions with subsidiary companies are classified as long-term receivable.

d) The financial applications (represented by LTN and ORTN Treasury Bonds) are entered at purchase cost plus the yield realized up to the closing date of the fiscal year.

e) The stocks are entered at the average purchase costs, which are lower than the market prices or the realizable net. Imports underway are entered at identified costs incurred up to the date of the balance.

f) The investments derived from corporation participation in subsidiaries are entered at the corrected cost.

g) The fixed assets are entered at the corrected cost of purchase or construction. Depreciation is calculated by the straight-line method through the application of rates that take into account the economic useful life of the assets.

h) The deferred items are shown at cost plus the monetary correction and are being amortized by the straight-line method for a period of 5 years up to 1987. Amortization of the projects underway or in the process of installation will begin when the respective units go into operation.

Note 3. Special Item:

This fiscal year, the company decided no longer to limit the monetary correction of the permanent assets to the amount necessary to compensate for correction of the net patrimony accounts, as it is authorized to do by Article 241 of the stock-corporation law, instead entering the correction of the balance in full. That procedure resulted in a credit surplus of 522,044,595,000 cruzeiros from the monetary correction of the balance. The amount of 163,410,710,000 cruzeiros, corresponding to the previously limited monetary correction, is listed as a special item in the statement of results.

Note 4. Stocks:

	(in 1,000 cruzeiros)	
	1984	1983
Production in process ("yellow-cake"), finished and fuel element	12,884,639	10,501,498
Raw materials	1,915,304	1,676,101
Indirect materials	4,630,105	1,931,497
Material being beneficiated (substantially enriched uranium)	92,184,539	65,379,143
Storehouse	1,689,704	1,072,963
Imports underway	14,073	6,619
	113,318,364	70,567,821

Note 5. Financing Granted:

This is intended to fully finance the costs of contracts for overall contract work and for supplying nuclear fuel for Units 2 and 3 of the Almirante Alvaro Alberto Nuclear Power Station signed between Furnas Electric Power Stations Corporation and the Nuclebras Nuclear Power Station Construction Corporation (NUCON) on 31 July 1981.

The financing yields interest calculated "pro-rata-tempore" on the corrected debit balances at weighted rates equivalent to the costs of acquisition of the funds.

The monetary correction is calculated on the debit balance at correction rates equivalent to those for the costs of acquisition of the funds (third-party funds portions) and to the variation of the value of the ORTN's (its own funds' portions).

All of the financing provides for guarantees by letter of guarantee signed by the Brazilian Electric Power Stations Corporation (ELETROBRAS).

Note 6. Investments:

(in 1,000 cruzeiros)

	Corporation participation in subsidiaries	Agio in associate	Others	Total
Position on 31 Dec 83	97,744,961	3,299,392	1,145,656	102,190,009
Increases in fiscal year	132,435,609	-	217,485	132,653,094
Decreases in fiscal year	-	(10,402,280)	-	(10,402,280)
Monetary correction	222,754,915	7,102,888	4,470,347	234,328,150
Adjustment of variation of percentage of participation in the capital of the subsidiary	1,440,885	-	-	1,440,885
Adjustment of patrimonial value of investment	(60,452,010)	-	-	(60,452,010)
Position on 31 Dec 84	393,924,360	-	5,833,488	399,757,848

Additional information on investments in the subsidiaries and the associate.

	NUCLAM	NUCLEI	NUCLEN	NUCLEP	NUCLEMON	NUCON	NUSTEP
Amount of capital subscribed and integrated	6,625,450	45,810,366	890,555	194,879,800	4,470,315	46,676,000	81,432
Number of shares or quotas	3,378,980	34,357,775	667,916	191,371,964	4,470,315	46,676	576
Types of shares	ON	ON	ON	ON	QUOTAS	ON/OP	QUOTAS
Net patrimony of subsidiaries	(8,477,307)	117,606,071	10,657	257,301,229	9,402,214	43,640,733	-
Base date	31/12	31/12	31/12	31/12	31/12	31/12	-
% of participation	51.00	75.00	75.00	98.20	99.99	100.00	50.00
Adjustment by variation of %	-	-	-	1,440,885	-	-	-
Adjustment by patrimonial equivalence	-	-	7,993	(46,662,825)	(93,811)	(13,703,367)	-
Profit (loss) for fiscal year	-	-	1,540,599	(46,654,336)	(93,667)	(13,703,743)	-
Accounts receivable	-	-	1,484,977	1,976,881	(905)	2,940,000	-
Loans granted	8,680,666	341,360,627	10,814,203	132,073,029	-	35,114,728	-
Advances to increase capital	416,107	-	-	-	1,948,723	5,558,013	36,112,395
Accounts payable	-	-	3,543,573	24,669,857	136	-	-
Revenues	6,359,876	230,530,204	-	138,269,025	1,976,577	-	22,885,201
Expenditures	-	-	14,096,106	-	-	27,803,422	-

The financial statements of the subsidiaries and the associate were examined by independent auditors.

The amounts receivable and payable shown above represent transactions of release of funds, supply of goods and services, reimbursable expenses the balances of which are paid at an average market acquisition rate as provided in the mutual contracts.

Note 7. Fixed:

	(in 1,000 cruzeiros)	
	1984	1983
Real estate	116,792,075	21,426,996
Machinery and equipment	215,878,741	38,112,757
Furnishings and fixtures	9,251,047	1,560,467
Vehicles	3,445,865	408,620
Improvements to assets of third parties	2,706,335	489,938
	348,074,063	61,998,778
Minus depreciation and accrued amortization	73,539,009	11,089,669
	274,535,054	50,909,109
Projects underway	130,522,031	24,324,978
Imports underway	-	90,988
Others	147,721	26,994
	405,204,806	75,352,069

Of the total depreciation or amortization in the fiscal year, 11,825,161 cruzeiros (4,001,233 in 1983) were absorbed in production costs and 3,448,343 cruzeiros (1,373,095 in 1983) were entered as general and administrative expenses.

Note 8. Deferred:

	(in 1,000 cruzeiros)	
	1984	1983
Expenditures on the uranium prospecting and exploration program	121,373,975	24,374,431
Preoperation expenditures	474,800,140	89,517,697
Expenditures in obtaining technical information, consultation and training	191,390,515	33,058,728
Loan and financing charges (minus those for active transactions)	421,428,982	78,517,352
Net monetary variations and monetary correction of permanent assets and net patrimony	(205,415,143)	(38,116,698)
Income tax on inflationary profit	123,712,473	20,666,723
Other expenditures (net of revenues)	70,465,204	16,554,320
	1,197,756,146	224,572,553

Minus accrued amortization	381,972,885	60,026,305
	815,783,261	164,546,248

Included in the figure of 1,197,756,146 cruzeiros is the amount of 515,164,560 cruzeiros pertaining to expenditures related to activities in the preoperational phase.

The amortization effected in the fiscal year, totaling 82,231,549 cruzeiros (27,931,942 in 1983), was totally charged to general and administrative expenses.

Note 9. Financing and Loans:

	(in 1,000 cruzeiros)	
	1984	1983
In national currency:		
With due dates by 1995 and subject to charges from 7.84% to 15% per annum and monetary correction	223,319,300	65,879,048
Minus portion with short-term due date	(124,423,823)	(34,036,381)
	98,895,477	31,842,667
In foreign currency:		
US $935,526,000 (1983, $723,015,000) with due date by 1991 and subject to charges of 7.28% to 14.4% per annum	2,978,714,231	711,448,463
DM 3,118,378,000 (1983, DM 2,181,332,000) with due date by 2003 and subject to charges of 7.2% to 11.4% per annum	3,174,191,399	787,406,913
FF 104,376,000 (1983, FF 92,255,000) with due date by 1991 and subject to charges of 7.2% to 7.7% per annum	34,686,556	10,915,894
Sw Fr 9,311 with due date by 1992 and subject to charges of 6.8% per annum	11,503,200	-
	6,199,095,386	1,509,771,270
Minus portion with short-term due date	(313,753,293)	(81,287,220)
	5,885,342,093	1,428,484,050
	5,984,237,570	1,460,326,717

The loans and financing in foreign currency are, for the most part, guaranteed by the endorsement of the Federative Republic of Brazil.

Note 10. Capital and Reserves:

The subscribed and integrated capital is represented by 19,899,693,198 common shares and 13,266,462,132 preferred shares valued at 9.00 cruzeiros each (6.20 in 1983).

The subsidies for investment are derived from the Single Tax on Lubricants and Liquid and Gas Fuels, from funds from agreements, for application in activities of research and development of nuclear minerals and technology, in the installation of nuclear fuel cycle units.

Note 11. Nuclebras Social Security Institute (NUCLEOS):

NUCLEBRAS and its subsidiaries sponsor NUCLEOS, a nonprofit organization the main objective of which is to establish private benefit plans complementary to or assimilated with the social security plans accessible to the employees, as well as to administer assistance programs promoted by its sponsors. The amount of contributions by NUCLEBRAS during the fiscal year totaled 1,500,404,000 cruzeiros (653,375,000 in 1982) [date as published] and was charged to general and administrative expenses.

NUCLEOS' benefit plan is valuated by an independent actuary according to specific legislation. The financial statements are examined by independent auditors.

Note 12. Subsequent Events

By Decree No 90,393 of 7 November 1984, the company was authorized to incorporate its full subsidiary, Nuclebras Nuclear Power Station. Construction Corporation (NUCON). The act of incorporation occurred on 3 January 1985 with the signing of the "protocol of incorporation," by which NUCLEBRAS succeeds the incorporated NUCON in all its rights and obligations. As a result of that fact, as of 1 January 1985, the company's net patrimony will be increased by the following summarized figures taken from NUCON's patrimonial balance for the fiscal year ending on 31 December 1984.

Assets		Liabilities	
Current	158,865,967	Current	110,864,291
Long-term receivable	4,558	Long-term payable	14,183,733
Permanent	10,407	Results of future fiscal years	668,839
		Surplus assets over liabilities	43,640,733
	169,357,597		169,357,596

Report of Fiscal Council

In accordance with current legislation and statutory provisions, the Fiscal Council of the Brazilian Nuclear Corporation (NUCLEBRAS) has examined the Annual Report of the Executive Borad of Directors on the activities of the company, as well as the Financial Statements that include the Patrimonial Balance, Statement of the Result, Statement of Changes in Net Patrimony,

Statement of Sources and Applications of Funds, Explanatory Notes to the Financial Statements and the Report of the Independent Auditors pertaining to the fiscal year ending 31 December 1984.

Based on the analysis conducted, the Fiscal Council is of the opinion that the items examined properly reflect the patrimonial and financial situation of NUCLEBRAS, wherefore, it recommends its full approval to the General Assembly of Stockholders.

Rio de Janeiro, 15 February 1985

Paulo Cabral de Araujo, Jose Goes de Campos Barros, Francisco Oswaldo Neves Dorneles; Boucinhas, Campos and Claro S/C, independent auditors.

Auditors' Report

Honorable Directors of the
Brazilian Nuclear Corporation (NUCLEBRAS):

1. We have examined the Patrimonial Balance of the Brazilian Nuclear Corporation (NUCLEBRAS) ending 31 December 1984 and the respective statements of the result, of the changes in net patrimony and of the sources and applications of funds pertaining to the fiscal year ending on that date. Our examination was made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

2. Previously, we examined and issued our report on the financial statements for the fiscal year ending 31 December 1983, the figures of which are presented for purposes of comparison.

3. In our opinion, the financial statements referred to in the first paragraph properly reflect the patrimonial and financial position of the Brazilian Nuclear Corporation (NUCLEBRAS) on 31 December 1984 and the sources and applications of its funds pertaining to the fiscal year ending on that date and, except for the fact mentioned in Note 3, the results of its operations and patrimonial changes pertaining to the same fiscal year, in accordance with generally accepted accounting principles applied in a consistent manner with reference to the previous year.

Rio de Janeiro, 31 January 1985

Boucinhas, Campos and Claro S/C; CRC.SP-5,528-S-RJ

Nilton Claro, accountant, CRC-RJ-10,316-5

Consolidated Patrimonial Balance

Assets

(in 1,000 cruzeiros)

	On 31 December 1984	1983
Current		
Cash and banks	2,176,741	896,196
Financial applications	14,736,512	20,233,641
Accounts receivable	22,949,000	2,913,088
Committed deposits-Central Bank (BACEN)	197,632,376	3,764,473
Recoverable costs of services and equipment underway	382,199,623	136,168,907
Others	8,404,011	4,745,501
Stocks	120,448,224	80,960,560
Expenses of next fiscal year	14,365,777	2,026,643
	762,912,264	251,709,009
Long-Term Receivable		
Advance to suppliers	26,921,673	9,764,330
Advance to associate-NUSTEP	36,112,395	11,831,235
Recoverable costs of services and equipment underway	7,138,383	3,828,400
Financing granted	4,971,652,815	1,294,618,885
Others	4,941,025	1,515,264
	5,046,766,291	1,321,558,114
Permanent		
Investments	6,030,476	4,502,957
Fixed	1,131,682,563	292,371,073
Deferred	1,017,102,289	246,674,897
	2,154,815,328	543,548,927
	7,964,493,883	2,116,816,050

Consolidated Patrimonial Balance

Liabilities

(in 1,000 cruzeiros)

	On 31 December 1984	1983
Current		
Suppliers	221,433,284	139,003,794
Financing and loans	491,307,260	120,500,318
Salaries and social charges	106,280,660	18,906,350
Provision for income tax	1,016,508	139,901
Others	10,428,033	7,373,280
	830,465,745	285,923,643
Long-Term Payable		
Suppliers	94,441,886	30,318,984
Financing and loans	6,280,292,492	1,565,457,488
Federal credit for future capital increase	267,782,295	83,918,953
Others	260,838	500
	6,742,777,511	1,679,696,125
Result of Future Fiscal Years		
Revenues of future fiscal years	606,865,532	218,378,791
Minus costs and expenses pertaining to revenues	570,446,054	201,348,033
	36,419,478	17,030,758
Participation of Minority Stockholders		
Net Patrimony	29,897,361	8,315,286
Authorized capital	365,511,153	117,192,105
Minus capital to be subscribed	67,015,755	21,378,767
Subscribed and integrated capital	298,495,398	95,813,338
Capital reserves	1,014,556,532	268,179,278
Accrued losses	(988,118,142)	(238,142,378)
	7,964,493,883	2,116,816,050

The explanatory notes are an integral part of the financial statements.

Executive Board of Directors: president, Dario Jose Goncalves Gomes, CPF: 000,583,516-04; director-superintendent, Jose Pinto de Araujo Rabello, CPF: 290,227,387-87; directors: Paulo Lima, CPF: 010,024,497-15; Ney Freire de Oliveira Junior, CPF: 006,428,783-20; Ilmar Penna Marinho Junior, CPF: 021,253,317-72; Wenceslau D'Avila Fernandes Magalhaes, CPF: 289,326,687-87; Accounting Department: accountant, Alex Borges Barreto, CRC-RJ-46,679-9-S-DF -533; CPF: 363,500,367-00

Consolidated Statement of Result

(in 1,000 cruzeiros)

	Fiscal Year Ending 31 December 1984	1983
Gross revenue from sales of goods and services	190,177,532	65,323,526
Minus returns, rebates, taxes and assessments on sales and services	5,763,748	2,242,905
Net revenue of sales of goods and services	184,413,784	63,080,621
Costs of goods and services sold	173,064,859	59,610,369
Gross operational profits (losses)	11,348,925	3,470,252
Operational expenses (revenues):		
General and administrative (including salaries of administrators: 840,141 in 1984 and 315,013 in 1983)	173,641,003	58,632,610
Financial (deducted from expenses, 4,484,565,898 cruzeiros in 1984 and 245,610,800 cruzeiros in 1983)	(133,820,548)	(152,074,407)
Prospecting and exploration	22,645,239	16,215,917
Other operational revenues	(11,082)	(16,432)
	62,454,612	(77,242,312)
Net operational profit (loss)	(51,105,687)	80,712,564
Net nonoperational revenues (expenses)	(9,410,681)	(4,006,355)
	(60,516,368)	76,706,209
Monetary correction of balance		
Of net patrimony	(444,599,460)	(255,867,588)
Of permanent assets	1,404,589,949	314,526,667
	959,990,489	58,669,079
Monetary variations from financing for fixed assets	1,201,169,206	342,835,750
	(241,178,717)	284,166,671
Loss before special item	(301,695,085)	(207,460,462)
Special item	163,410,710	-
Loss before income tax	(138,284,375)	(207,460,462)
Income tax	(1,016,508)	34,235,140
	(139,300,883)	(173,225,322)
Minority participation	454,637	4,942,569
Net loss for fiscal year	(138,846,246)	(168,282,753)

The explanatory notes are an integral part of the financial statements.

Consolidated State of Sources and Applications of Funds

	(in 1,000 cruzeiros) Fiscal Year Ending 31 December 1984	1983
Sources:		
From stockholders:		
Federal credits for future capital increase	165,249,999	78,467,489
Integration of capital	637	403,538
From third parties:		
Transfer of fixed and deferred to current assets	11,825,161	4,001,232
Subsidies for investment	1,507	1,736,269
Increase of long-term financing	1,314,810,975	272,989,340
Foreign suppliers	18,814,777	14,784,119
Others	4,181,423	8,147,377
Total of sources	1,514,884,479	380,529,364
Applications:		
In operations:		
Net loss for fiscal year	139,300,883	173,225,322
Minus charges that do not represent outflow of funds:		
Decrease of permanent assets	10,706,937	770,017
Depreciations and amortizations	102,703,720	38,596,004
Monetary variations on long-term debt	3,712,364,158	976,906,739
Financial charges on long-term debt	4,390,539	-
Plus revenues that do not represent inflow of funds:		
Income tax	-	34,225,289
Charges on financing granted to Furnas Electric Power Stations Corporation	3,401,133,364	948,698,479
Monetary variations of long-term receivables	42,492,374	8,964,747
Debit result of monetary correction	1,123,401,199	58,669,079
Variations in the result of future fiscal year	-	1,434,563
	876,162,466	208,944,719
In the permanent assets:		
Acquisition of property of permanent assets	66,359,559	28,782,017
Increase of deferred assets	81,937,366	35,412,317
Increase of investments	220,996	247,615
	148,517,921	64,441,949
For other purposes:		
Increase of advances for future capital increase	1,695,959	183,498
Financing granted	253,257,019	42,090,851
Transfer of long-term obligations to short term	261,345,362	-
Others	7,244,599	-
	523,542,939	92,553,992
Total applications	1,548,223,326	365,940,660
Increase (Reduction) of Net Current Capital:	(33,338,847)	14,588,704

Explanatory Notes to the Consolidated Financial Statements

Note 1. Operations:

The Brazilian Nuclear Corporation (NUCLEBRAS) is a joint-economy corporation formed as the executing agency of the federal government's monopoly in the nuclear energy sector, the principal activities of which are mineral prospecting and exploration, the production of uranium concentrate, the development and installation of the conversion unit, the manufacture of the fuel element, the development of the reprocessing unit, the supplying of assets and equipment for the construction of nuclear-electric plants and the financing of construction of those plants.

Note 2. Consolidation Procedures:

For purposes of consolidation, the following subsidiaries have been included, in addition to the controlling corporation.

	% of participation in		Operational stage in	
	1984	1983	1984	1983
Nuclebras Heavy Equipment Corporation (NUCLEP)	98.20	97.64	In operation	In operation
Nuclebras Isotopic Enrichment Corporation (NUCLEI)	75.00	75.00	In process of installation	
Nuclebras Mining Auxiliary Corporation (NUCLAM)	51.00	51.00	In preoperation	
Nuclebras Monazites and Associated Minerals Corporation (NUCLEMON)	99.99	99.99	In operation	In operation
Nuclebras Engineering Corporation (NUCLEN)	85.00	75.00	In operation	In operation
Nuclebras Nuclear Power Station Construction Corporation (NUCON)	100.00	100.00	In operation	In operation

Among the procedures adopted in the preparation of the consolidated financial statements, the following may be noteworthy:

a) Deletion of the balances receivable and payable between the companies included in the consolidation;

b) Deletion of the revenues, expenditures and results of transactions made between companies;

c) Deletion of NUCLEBRAS' investments in the subsidiary companies against the corresponding portions of the net patrimony of those companies;

d) Deletion of the result of valuation, by the patrimonial equivalence method, of investments in the companies included in the consolidation;

e) Emphasis on the participation of the minority shareholders in the net patrimony and the statement of the result.

Note 3. Principal Accounting Practices:

a) The result is determined by the system of fiscal year accountability, thus, including:

--the revenues earned in the period and the corresponding costs, charges and expenses incurred, independent of their actual receipt or payment;

--the net effects of the monetary correction of the fixed assets and the net patrimony and of the monetary or foreign exchange variations, at official indices and rates, that accrue to the current and long-term liabilities;

--the charges corresponding to depreciation of the fixed assets and amortization of the deferred.

b) The assets receivable and liabilities payable in a period of up to 360 days are classified as current.

c) The financial applications (representated by LTN and ORTN Treasury Bonds) are entered at purchase cost plus the yield realized up to the date of the close of the fiscal year.

d) The stocks are entered at average purchase costs, which are lower than the market prices or the realizable net. Imports underway are entered at identified costs incurred up to the date of the balance.

e) The fixed assets are entered at the corrected cost of purchase or construction. Depreciation is calculated by the straight-line method through the application of rates that take into account the economic useful life of the assets.

f) The deferred items are shown at cost plus the monetary correction and are being amortized by the straight-line method for a period of 5 years up to 1987. Amortization of the costs of the projects in progress or in the process of installation, as well as those that are being incurred by the companies in preoperation (NUCLEI and NUCLAM), will begin when the respective units go into operation.

Note 4. Special Item:

This fiscal year, the company decided to no longer to limit the monetary correction of the permanent assets to the amount necessary to compensate for correction of the net patrimony accou , as it is authorized to do by Article 241 of the stock-corporation law, instead entering the correction of the balance in full. That procedure resulted in a credit surplus of 959,990,489 cruzeiros from monetary correction of the balance. The amount of 163,410,710 cruzeiros, corresponding to the previously limited monetary correction, is listed as a special item in the statement of results.

Note 5. Stocks:

	(in 1,000 cruzeiros)	
	1984	1983
Production in process ("yellow-cake"), finished and fuel element	15,709,620	11,656,109
Raw materials	3,624,077	2,395,187
Indirect materials	4,630,105	1,931,497
Material being beneficiated (substantially enriched uranium)	92,184,539	55,379,143
Storehouse	4,168,066	2,270,891
Imports underway	131,817	7,327,733
	120,448,224	80,960,560

Note 6. Financing Granted:

This is intended to fully finance the costs of contracts of overall contract work and for supplying nuclear fuel for Units 2 and 3 of the Almirante Alvaro Alberto Nuclear Power Station signed between Furnas Electric Power Stations Corporation and the Nuclebras Nuclear Power Station Construction Corporation (NUCON) on 31 July 1981.

The financing yields interest calculated "pro-rata-tempore" on the corrected debit balances at weighted rates equivalent to the cost of acquisition of the funds.

The monetary correction is calculated on the debit balance at correction indices equivalent to those for the costs of acquisition of the funds (third-party funds portion) and to the variation of the value of the ORTN's (its own funds' portion).

All of the financing provides for guarantees by letter of guarantee signed by the Brazilian Electric Power Stations Corporation (ELETROBRAS).

Note 7. Fixed:

	(in 1,000 cruzeiros)	
	1984	1983
Real estate	245,108,882	62,116,927
Machinery and equipment	389,987,905	92,754,388
Furnishings and fixtures	17,358,267	4,213,573
Vehicles	6,583,293	1,153,885
Improvements to assets of third parties	4,667,036	1,088,265
Others	15,905,001	54,040
	679,610,384	161,381,078
Minus depreciation and accrued amortization	148,593,499	27,732,743
	531,016,885	133,648,335
Projects underway	517,580,998	133,358,612
Imports underway	61,803,319	14,576,565
Others	21,281,361	10,787,561
	1,131,682,563	292,371,073

Of the total depreciation or amortization in the fiscal year, 19,961,912 cruzeiros (5,246,983 in 1983) were absorbed in production costs, 5,685,056 cruzeiros (2,068,010 in 1983) were entered as general and administrative expenses and 4,134,213 cruzeiros (2,571,740 in 1983) assigned to the deferred assets.

Note 8. Deferred:

	(in 1,000 cruzeiros)	
	1984	1983
Expenditures on the uranium prospecting and exploration program	116,927,131	27,941,564
Expenditures on development of the Pocos de Caldas deposit	474,800,140	89,517,697
Expenditures in obtaining technical information, consultation and training	234,946,688	46,686,023
Financial expenses (revenues), monetary corrections and net monetary variations	132,446,721	35,196,831
Income tax on inflationary profit (including reversion due to factor changes in the amount of 6,137,491 cruzeiros)	123,712,473	20,666,723
Costs not applied to production	99,216,309	24,559,213
Expenses of organization, administration and other expenditures	273,993,181	72,801,994
	1,456,042,643	317,370,045
Accrued amortizations	(438,940,354)	(70,695,148)
	1,017,102,289	246,674,897

The amortization effected in the fiscal year, totaling 96,541,142 cruzeiros (32,740,314 in 1983) was totally charged to general and administrative expenses.

Note 9. Financing and Loans:

	(in 1,000 cruzeiros)	
	1984	1983
In national currency:		
With due dates by 1995 and subject to charges ranging from 7.84% to 15% per annum and monetary correction	248,799,741	74,348,260
Minus portion with short-term due date	(133,169,456)	(35,693,905)
	115,630,285	38,654,355
In foreign currency:		
US $946,692,000 (1983, $723,015,000) with due date by 1991 and subject to charges of 7.28% to 14.4% per annum	3,014,266,938	722,807,716
DM 3,77,440,000 [as published] (1983, DM 2,181,332,000) with due date by 2003 and subject to charges of 7.2% to 11.4% per annum	3,462,343,317	877,886,136
FF 104,376,000 (1983, FF 92,255,000) with due date by 1991 and subject to charges of 7.2% to 7.7% per annum	34,686,556	10,915,894
Sw Fr 9,311 with due date by 1992 and subject to charges of 6.8% per annum	11,503,200	-
	6,522,800,011	1,611,609,746
Minus portion with short-term due date	(358,137,804)	(84,806,413)
	6,164,662,207	1,526,803,333
	6,280,292,492	1,565,457,688

The loans and financing in foreign currency are, for the most part, guaranteed by the endorsement of the Federative Republic of Brazil.

Note 10. Capital and Reserves:

The subscribed and integrated capital is represented by 19,899,693,198 common shares and 13,266,462,132 preferred shares valued at 9.00 cruzeiros each (5.20 in 1983).

The subsidies for investment are derived from the Single Tax on Lubricants and Liquid and Gas Fuels, from funds from agreements, for application in activities of research and development of nuclear minerals and technology, in the installation of nuclear fuel cycle units.

Note 11. Nuclebras Social Security Institute (NUCLEOS)

NUCLEBRAS and its subsidiaries sponsor NUCLEOS, a nonprofit organization the main objective of which is to establish private benefit plans complementary to or assimilated with the social security plans accessible to the employees, as well as to administer assistance programs promoted by its sponsors. The amount of contributions by NUCLEBRAS and its subsidiaries during the fiscal year totaled 2,778, 487,000 (1,374,743,000 in 1983) and was charged to general and administrative expenses.

NUCLEOS' benefit plan is valuated by an independent actuary according to specific legislation. The financial statements are examined by independent auditors.

Note 12. Subsequent Events:

By Decree No 90,398 of 7 November 1984, the company was authorized to incorporate its full subsidiary, Nuclebras Nuclear Power Station Construction Corporation (NUCON). The act of incorporation occurred on 3 January 1985 with the signing of the "protocol of incorporation," by which NUCLEBRAS succeeded the incorporated NUCON in all its rights and obligations. As a result of that fact, as of 1 January 1985, the company's net patrimony will be increased by the following summarized figures taken from NUCON's patrimonial balance for the fiscal year ending on 31 December 1984:

Assets		Liabilities	
Current	158,865,967	Current	110,864,291
Long-term receivable	4,558	Long-term payable	14,183,733
Permanent	10,487,071	Results of future fiscal years	668,839
		Surplus assets over liabilities	43,640,733
	169,357,071		169,357,596

Note 13. Correspondence Between the Net Loss and Net Patrimony of the Controlling Corporation and the New Loss and Net Patrimony of the Consolidated Group:

Counter-balancing the figures reveals the following situation:

	Net Loss (in 1,000 cruzeiros)		Net Patrimony	
	1984	1983	1984	1983
Position of the controlling corporation	142,733,753	108,159,427	668,795,643	204,880,211
Deletions derived from transactions between the consolidated companies, considered only for purposes of consolidation, as follows:				
Deletion of portion of portion of profits contained in cost of future fiscal years	17,689,764	4,807,900	(17,689,764)	(4,807,900)
Deletion of financial revenue received by the controlling corporation from the subsidiaries: NUCLAM and NUCLEI	236,890,080	54,901,193	(305,330,553)	(68,457,303)
Deletion of monetary correction of financial revenues received by the controlling corporation from the subsidiaries: NUCLAM and NUCLEI	(256,862,102)	-	-	-
Adjustment of previous fiscal years pertaining to profits contained in costs of services underway and in costs of future fiscal years	-	-	(8,870,010)	(4,062,110)
Others	(1,605,249)	414,233	(11,971,528)	(1,702,660)
Position of the consolidated group	138,846,246	168,282,753	324,933,788	126,850,238

Auditors' Report

Honorable Directors of the
Brazilian Nuclear Corporation (NUCLEBRAS):

1. We have examined the consolidated patrimonial balance of the Brazilian Nuclear Corporation (NUCLEBRAS) and subsidiaries ending 31 December 1984 and the respective consolidated statements of the result and the sources and applications of funds for the fiscal year ending on that date. Our examination was made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

2. Previously, we examined and issued our report on the financial statements for the fiscal year ending 31 December 1983, the figures of which are presented for purposes of comparison.

3. In our opinion, the consolidated financial statements referred to in the first paragraph properly reflect the consolidated patrimonial and financial position of the Brazilian Nuclear Corporation (NUCLEBRAS) and subsidiaries on 31 December 1984 and the sources and applications of its funds pertaining to the fiscal year ending on that date and, except for the fact mentioned in Note 4, the results of its operations pertaining to the same fiscal year--in accordance with generally accepted accounting principles applied in a consistent manner with reference to the previous year.

Rio de Janeiro, 8 February 1985

Boucinhas, Campos and Claro S/C; CRC.SP-5,528-S-RJ

Nilton Claro, accountant, CRC-RJ-10,316-5

8711
CSO: 5100/2075

BRAZIL

NUCLEBRAS SHIPS URANIUM CONCENTRATE TO UK

Sao Paulo GAZETA MERCANTIL in Porguese 14 Feb 85 p 12

/Article by Aldo Palma/

/Text/ Yesterday afternoon, the Mineral Industry Complex of the Pocos de Caldas Plateau (CIPC), general superintendency of the production area of NUCLEBRAS /Brazilian Nuclear Corporation/ located in Caldas, Minas Gerais State, shipped 50 tons of yellow cake (uranium concentrate), mined and processed at that facility, to the English firm, British Nuclear Fuels Ltd.

"Each kilo of yellow cake now costs about $100, but exports of the product are not treated as foreign exchange; rather, they are considered as partial payment on the debt which the Brazilian Government incurred in putting together its nuclear program when yellow cake was obtained from Germany, France, Argentina and England," Jose Milton Sampaio, CIPC's general superintendent, told our newspaper.

The complex, known in the area as Campo do Cerrado, required an investment of $230 million, to be paid back within 10 years, when it was foreseen that the reserves would be exhausted. CIPC's capacity is 400 tons annually of yellow cake, but only 150 tons of mined and processed yellow cake are foreseen for 1985 due to lack of funds, according to Sampaio.

Operation

The mine, called Osamo Utsumi, is about 1 km in diameter and 100 meters deep. Its operation is under the responsibility of the Andrade Gutierrez contracting firm, with technical guidance being given by NUCLEBRAS. Exploitation of uranium ore at the mining complex, which covers an area of 1,700 hectares, began in 1981 when 65,000 tons was extracted.

Armundo Henriques da Conceicao, CIPC's technical superintendent, explained that, after extraction of the ore, the product is crushed and then pumped to the plant. The first step in the processing at the plant is passing the product into tanks of sulfuric acid.

"At this moment the uranium is actually extracted from the ore; it is then filtered and subjected to specific treatment with solvents. With the addition of ammonia, the uranium is finally dry, being converted into yellow cake," Conceicao said.

The above process requires from 2 to 3 days. The uranium concentrate is then placed in containers and transported by truck to the port of Santos.

Pollution

Yesterday, NUCLEBRAS opened the doors of the mining complex to attempt to show the press and people of the area that it is not responsible for the change, not yet diagnosed, of the waters of Bortolan Dam which supplies Pocos de Caldas, where thousands of dead fish were found at the beginning of this month. A committee of inquiry is scheduled to begin an investigation today.

8568
CSO: 5100/2074

BRAZIL

BRIEFS

ATOMIC BOMB CALLED 'UTOPIA'--Upon taking office yesterday at the newly established Secretariat of Science and Technology of the Army, Div Gen Haroldo Erichsen da Fonseca, 61 years of age, its first director, asserted that "technological self-sufficiency in the war materiel sector is a matter of national security." In an interview after the ceremony, Fonseca said that, in the present technological phase of the war materiel sector, the manufacture of the atomic bomb "is a utopia. If we merely succeed in becoming modernized, we shall have accomplished a lot," he stated. The inaugural ceremony did not last more than a half hour ; it was presided over by Gen Heraldo Tavares Alves, commander of the 1st Army, 65 years of age, representing Gen Walter Pires, minister of the army. Present at the ceremony were 16 officials of the armed forces, a number of civilians and representatives of war material industries. In his inaugural speech Erichsen Fonseca stated that technological dependence in the war materiel sector "could be fatal. Here we have the example of Argentina, which suffered serious limitations in replacing its war materiel during the Malvinas war, a situation which greatly contributed to the failure of the campaign." In an interview the general said that interest in science and technology is of a general nature, "at the point where President Tancredo Neves is thinking of establishing a ministry of science and technology." He stated that the army's policy will be to continue to develop projects to be carried out by civilian industry. "And that is of interest because of export," he said. /Text/ /Sao Paulo FOLHA DE SAO PAULO in Portuguese 15 Feb 85 p 6/ 8568

CSO: 5100/2074

BANGLADESH

AEC CHIEF'S POSITION ON NUCLEAR POWER SUPPORTED

Dhaka THE NEW NATION in English 3 Feb 85 p 5

[Editorial]

[Text]

The International Conference on Physics and Energy for Development, organized by the Bangladesh Physical Society in Dhaka, has indicated new areas in which the country could strive towards all-round progress. A revealing statement was that made by the Chairman of the Atomic Energy Commission, Dr. Anwar Hossain, on the need to develop nuclear power in order to meet the growing demand for electricity. It is significant that the AEC chief considers nuclear power as the only alternative vis-a-vis the need for electricity.

Indeed, Bangladesh's preoccupation with nuclear energy dates back to the nineteen sixties; and it was a preoccupation that was prompted by the fact of inadequate exploitable fossil reserves and limited potential for hydro-electricity. Over the years, the question of utilizing nuclear power has, quite naturally, led to a number of feasibility studies and even to the selection of a site for a possible nuclear plant at Rooppur. In addition to such measures, a nucleus of trained manpower was created to implement the programme. Unfortunately, as Dr. Hossain has pointed out, the greatest difficulty faced

by Bangladesh on the overall question of nuclear power is the issue of high capital cost. While that is true, there is another truth that ought to be perceptible to all; and that is, the use of nuclear fuel, after a period of six or seven years, will begin to deliver profitable returns. The AEC Chief would also like us to believe that since the nuclear power station is capable of generating power at a very high plant factor, repayment of the costs incurred in the construction and initial operation of the plant will not be difficult.

It would be proper, in the present circumstances, to consider the AEC Chairman's views in a serious vein. If an interim report, quoted by Dr. Hossain, suggests that the projected energy requirement in Bangladesh in 2000 A.D. will be over 8000 mega watts (according to the maximum probable forecast) and 5000 mega watts (according to bench mark projections), it is time certainly to initiate the process of nuclear power generation. If the aim is indeed to discover viable alternatives to oil and electricity in a developing economy, it is imperative that steps be taken towards the implementation of the nuclear power project. The idea that took shape in the sixties must now lead to a concrete plan and subsequent operation in 1990, if not earlier.

CSO: 5150/0030

BRIEFS

NUCLEAR REACTOR PLANS--Bangladesh is entering nuclear age when the nation's first nuclear reactor is installed next month at Savar Nuclear Research Complex of the Atomic Energy Commission. A three megawatt nuclear reactor to be used for research purposes reached Dhaka a few says ago from the United States. The small reactor was purchased at a cost of 4.5 million dollars and the total including that of the installation will come around 5 million dollars, it is learnt. The reactor purchased from an American company with finances entirely from Bangladesh reached the country six months behind schedule. When installed the reactor will help train the nation's nuclear scientists helping them to boost various research projects taken up by the Atomic Energy Commission. Bangladesh ratified the Nuclear Non-Proliferation Treaty in 1979 and the nuclear safeguard provisions of the International Atomic Energy Agency (IAEA) in 1980. [Text] [Dhaka THE BANGLADESH TIMES in English 10 Feb 85 p 1]

CSO: 5150/0031

EGYPT

PLANS FOR UP TO TEN NUCLEAR POWER PLANTS OUTLINED

Frankfurt/Main FRANKFURTER ALLGEMEINE in German 1 Feb 85 p 17

[Text] Brown, Boveri & Cie AG (BBC). Baden (Switzerland)--The Egyptian government is already planning to use nuclear energy in the near future. The growing energy needs of the country whose population increases annually by one million and is currently at 47 million people are expected to be met by nuclear power plants, but also by conventional ones, which will be operated primarily by natural gas in an effort to preserve the limited oil supplies. Orginally, the five-year plant called for up to ten nuclear power plants each having up to 1,000 megawatts capacity. These projects have been cut back noticeably in the meantime, probably out of financial considerations. Egypt is seeking contractors for these power plants who will also provide financing for the individual projects estimated at two to three billion DM each. As Minister of Energy Maher Abaza related to journalists in Cairo, Egypt wants to build one or two nuclear power plants next and the others as the need arises. Bids on the project and on financial assistance will be accepted until the end of June so that the contract can be signed sometime in October.

Until now KWU, Westinghouse with Brown, Boveri & Cie and the French firm Framatome have competed for the contract for these initial nuclear power plant projects in the most populous Arabic country. While Westinghouse had already submitted a bid on financial assistance some time ago, it was Wednesday that the Bonn Cabinet Council meeting decided on the long debated ruling. Accordingly, the FRG is securing a bond on the export of a reactor. Kraftwerk Union AG has placed a request for a bond for a credit volume of about two billion DM (FAZ, January 31st). During Federal President von Weizsaecker's state visit to Egypt February 5th to 8th, it is expected that the accompanying Foreign Minister will have this decision with him in his travel case. The chances are good for the German bidders on the power plant projects and for Westinghouse, at any rate. Observers consider it possible that the Egyptian government would decide to have the two power plants built simultaneously by both bidders, providing that the bids on financial assistance were suitable.

If the contract were awarded to Westinghouse who would then supply the nuclear parts, it is likely that the electro-technical firm BBC would then have a chance at delivering the conventional power plant parts which could amount to

500 million to one billion DM. BBC considers itself to be the leading firm in the electro-technical heavy current commerce in Egypt. According to its own figures and on the average in the past three years, BBC's involvement in the expansion of the country's generation and distribution of heavy current amounted to up to 15 - 20 percent. The firm's leading moneymaker in the Egyptian sector, which represents about 200 million Swiss francs (1984), until now has been the gas turbine power plants with a 50 percent share, and the current distribution facilities and industrial equipment, each having a 15 percent share.

Renauld Thomas, group executive for Egypt in the Swiss corporate headquarters, and Aref Hakki, head of the BBC office in Cairo, believe that the construction of power plants and the distribution of current will remain the growth sector of BBC operations in the next few years. Egypt is striving to quadruple power plant capacities until the year 2010 from the present-day 5,000 megawatts to 20,000 - 25,000 megawatts. That means an annual increase of about 1,000 megawatts.

Brown, Boveri, which considers Egypt to be a long-term growth market with an old industrial tradition, intelligent populace and a geographically interesting area, has completed projects in Egypt in the post-war period amounting to about two billion DM. The initial business activities go back as far as the 1930's when BBC established one of the first overhead power lines in Upper Egypt. In the post-war period, the BBC installed the generators for the old Aswan power plant, among other things. In the current delivery schedule the major points are the generation and distribution of electricity, and electrical equipment for industry, transportation and communication. Besides numerous small gas turbine power plants with capacities of up to 100 megawatts, a power line was erected over the Nile not too long ago near Luxor. The industrial installations sector built cement factories, which plan an important role in the import-dependent Egyptian construction market, fertilizer factories, [orders in] the textile industry, and refineries. Besides the transmitting station and electrical equipment for water supplies, the BBC is presently equipping large train compartments with air conditioners through a contract with the Egyptian railway system.

The firm's Egyptian operations overflow into the BBC's own organizations, as well as the joint-venture firm Arab Contractors for Electrical Industries, SAE, whereby the BBC negotiated a 30 percent share using 3.5 million Swiss francs with the Egyptian general firm Arab Contractors belonging to the Ossman group. Since 1982, the special partnership has been building medium and low voltage switching equipment in a new factory with 500 employees and with a turnover of about 30 million Swiss francs.

The Swiss parent firm of the electro-technical company ended the 1984 fiscal year with a turnover of probably 10 (10.66) billion Swiss francs, excluding the new acquisition in Italy. According to information from a company spokesperson, incoming orders were significantly above the 10.5 billion francs of the previous year. The cash flow increased by about 10 percent over the 464 million francs of the previous year. The total amount of employees diminished to about 88,000 (90,000).

12348
CSO: 5100/4605

INDIA

AEC CHAIRMAN SPEAKS PROUDLY OF REACTOR FUEL CAPACITY

BK181254 Delhi THE HINDUSTAN TIMES in English 9 Mar 85 p 5

[Text] Bombay, March 8 -- When the Fast Breeder Test Reactor (FBTR) at Kalpakkam goes on stream in August next, India would gain the pride of being the first country in the world to use mixed uranium-plutonium carbide as the driver fuel for a nuclear reactor.

Disclosing this to newsmen here today Atomic Energy Commission Chairman Raja Ramanna said the manufacture of FBTR fuel from totally indigenous resources has established India's success in achieving self-reliance in such a sophisticated and front-line nuclear technology. This has generated utmost confidence in our venturing in the manufacture of fuels for the future larger prototype fBR-500.

Brimming with confidence, he said the country had developed indigenous capability for the entire spectrum of activities from the design and construction of nuclear power reactors to the establishment of facilities for the front and the back ends of the nuclear fuel cycle. "We can produce nuclear power, through indigenous efforts, with safety and economy," he added.

He said the country's competence in this direction is clear from the fact that our 15-year plan for generation of nuclear power of 10,000 mw at a cost of nearly rs 14,000 crore (at 1983 prices) would not have a foreign exchange content of more than three percent.

The five nuclear plants operating in the country were givine a net surplus of rs 150 crore a year. With the implementation of the 15-year plan of 12 plants of 235 mw each and 10 plants of 500 mw each, the net revenue earned by the nuclear power during 1984 -- 2,025 will be a minimum of rs 60,100 crore. It would be possible to have an installed capacity of 3.50 lakh mw by the latter half of the next century, Mr Ramanna said.

He asserted, nuclear power is dependable, clean, safe, economically competitive or even cheaper energy option for the present and foreseeable future.

Mr Ramanna was assisted by Nuclear Board Chairman M R Srinivasan, BARC [Bhabha Atomic Research Center] Director P.D. Iyengar and nuclear fuel complex Chairman N. Srinivasan at the press conference. It was disclosed that France had agreed to meet the Tarapur atomic power station fuel demands up t 1993.

Dr Srinivasan said, "We have found that we do not need foreign help in the matter of spare parts for this power house."

They said the location of various power stations in the next 15 years was being considered and will be announced, after a decision has been taken for the eastern region. Dr Ramanna said, two units of 235 mw each will be located there near Kalinadi in north Kanwar District in Karnataka. Another two units of the same capacity will be located at Kota (Rajasthan), where there are already two units. These units will be established in eight years.

An other major development is that the conceptual design of various systems and plant layouts has been completed for the 235 mw and 500 mw pressurised heavy water reactors. The feasibility report has been approved by the Atomic Energy Commission in principle.

The project schedule envisages commissioning of the first 500 mw unit by 1995. The construction work is slated to begin in January 1987.

Dr Ramanna said that the country has developed the capacity to concert nuclear waste into nonleachable vitrified glass which helps in storing the nuclear waste. The first radioactive glass block of 40 litre volume, was cast on March 4 last.

CSO: 5100/4732

INDIA

BRIEFS

KALPAKKAM NUCLEAR PLANT--Madras, Feb 26--The 235 MW unit at the Madras Atomic Power Station at Kalpakkam is expected to resume generation on March 3, almost three months after it was taken off the grid for annual maintenance and repairs to the turbine generator. According to a press release from the Department of Atomic Energy, all jobs on the nuclear systems have been completed and the turbine generator, which had to be dismantled, has now been assembled. Authorities are in the final stages of aligning the rotor. The annual maintenance had been scheduled in February but was taken up in December itself when the unit tripped due to problems in the turbine. The unit, which was commissioned on July 23, 1983, has generated 1,478 million units of energy so far, supplying 1,272 million units of this to the Tamil Nadu grid. The return of the 235 MW unit should provide considerable relief to consumers in Tamil Nadu where large scale load-shedding has been resorted to by the TNEB because of inadequate generation. Authorities hope that the situation will improve in the first week of March when a 110 MW unit at Ennore is also expected to be put back on bars. [Text] [Madras THE HINDU in English 27 Feb 85 p 1]

CSO: 5150/0035

PAKISTAN

CONTINUED EFFORTS FOR NUCLEAR ENERGY STRESSED

GF101135 NAWA-I-WAQT in Urdu 5 Mar 85 p 3

[Editorial: "Wheat and Nuclear Energy"]

[Excerpt] It is a well-known fact that wheat is an essential item in the world today. However, if we have to live in the world with dignity, which we would like to do, and if we are to carve a niche for ourselves in the ranks of the free countries of the world then we should not content ourselves with being self-sufficient in wheat production. We need modern arms, fighters, bombers and such weaponry and aircraft with which we can defend our country's independence, because according to the "poet of the East" [Pakistani poet Iqbal], if you want to live, live in danger.

The ordnance requirements that we have mentioned require technology that the Muslim countries do not currently possess because we are in the category of newly liberated countries. Unfortunately we do not even possess the natural resources that are plentiful in other Muslim countries. In light of this, we see the real problem as one of energy. Whatever we earn by way of foreign exchange is spent on oil imports.

The only solution is for us to progress in the field of nuclear energy, but our so-called friends and allies are not in favor of our obtaining nuclear energy and technology. Among our "mentors" are our Western friends and Eastern critics who state that if we acquire nuclear technology then we will not use it for works and factories but will manufacture the "Islamic bomb" instead. That should only be the monopoly of the capitalists, the Communists, Jews and Hindus. The Muslims should not even get wind of it.

As Pakistanis we are not ready to compromise with this mentality of capitalists and Communists, in fact we should not even contemplate such a thing. Instead we should continue efforts to progress in the field of nuclear energy.

If we continue this quest with sincere intentions and honesty then success will definitely be ours. The world will see that we are self-sufficient in wheat as well as nuclear energy, and may that day dawn soon. Amen!

CSO: 5100/4731

NIGERIA

EMIR CALLS ON GOVERNMENT TO MOVE URANIUM FIRM

Kaduna NEW NIGERIAN in English 16 Feb 85 pp 1, 13

[Article by Nkem Agetua and Abdullahi Idris]

[Text]

THE Emir of Biu, Alhaji Mustapha Aliyu has called on the Federal Military Government to review the siting of the headquarters of the Nigerian Uranium Company which is currently in Bauchi State.

Welcoming the Head of State, Major-General Muhammadu Buhari in his palace in Biu on Wednesday, the emir said the siting of the headquarters in Bauchi was politically motivated.

He said the choice was done at a time when exploration results had favoured locating the headquarters in Borno State where the bulk of the mineral was found.

Alhaji Mustapha also called on the Federal Government to intensify its exploration programme in Biu emirate because there were many minerals suspected to be available in the area.

He said the government should intensify and modernise agricultural activities and also establish agro-based industries to tap the vast agricultural potentials of the area.

Responding, General Buhari assured that no part of the country would be left out in the development projects of the nation.

When he visited Gashua on Thursday, General Buhari said the scourge of drought in the area was probably worse than anywhere else in the country.

He said Rivers Kumadugu and Yobe which were the main source of water for the area were drying up because of drought and not due to the activities of the Kano — Hadejia River Basin Development Authority up-stream.

The Head of State however assured that the authority would improve the flow of water when their projects were completed.

Earlier, the Emir of Bade, Alhaji Saleh Suleiman II said the emirate which was one of the main suppliers of rice and fish to northern states could now not meet its local demands.

The emir attributed this to drought and blockage of rivers Kumadugu and Yobe upstream by the authority.

CSO: 5100/18

SOUTH AFRICA

BRIEFS

BOYCOTT HELPS NUCLEAR TECHNOLOGY -- Boycotts aimed at preventing South Africa from becoming a nuclear power have laid the foundation that will enable South Africa now or in the future to develop into such a power, said Dr Boy Geldenhuys (NP [National Party], Randfontein) yesterday in the House of Assembly during the second reading debate of the amendment on nuclear energy. The development of three nuclear installations is a monument to South Africa's technology. South Africa has been successful in enriching uranium and is now capable of providing nuclear fuel for Koeberg. The enrichment of uranium took place without blueprint in record time and he considers this an unparalleled scientific achievement. He said that there are numerous ghost stories about the unsafeness of nuclear reactors. However, people are being exposed to radiation every day. The radioactivity from a nuclear reactor equals 1 milliroentgen. Luminous paint on the face of a watch produces twice as much radioactivity as such a nuclear power station and a radiographer is allowed to receive 5,000 milliroentgen. Dr Geldenhuys made a comparison of disaster projections and said that the probability of 100 people dying in an airplane disaster is 1 in 2 years; in a tornado, 1 in 5 years; whereas the probability of a nuclear disaster is 1 in 10,000 years. Dr Johan Vilionel (NP, Benoem) stated that it is necessary to look regularly at the legislation on nuclear energy so that confidence is also instilled in the people. As for the accountable aspects of the legislation in question, he said that in times of financial difficulties and when problems have recently developed in similar organizations it is necessary to take a look at them. [Text] [Cape Town DIE BURGER in Afrikaans 7 Feb 85 p 9] 8463

CSO: 5100/14

FINLAND

GOVERNMENT SUBMITS NUCLEAR ENERGY BILL TO PARLIAMENT

Fund for Nuclear Waste

Helsinki HUFVUDSTADSBLADET in Swedish 23 Feb 85 p 15

[Article by Matts Dumell: "Nuclear Energy Law: State Borrows 25 Percent From New Waste Fund"]

[Text] A proposal for a new nuclear energy law was submitted to the parliament yesterday with a speech by the president. The main points of the bill are:
- Henceforth the government will make the fundamental decision when new nuclear units are to be established.
- The parliament will make the final decision as to whether it is in the total interest of the community. That will be a single process.
- Decisions on new nuclear power units will not be made against the wishes of the municipalities.
- A new fund for disposal of waste will be established and managed by the Ministry of Trade and industry. Twenty-five percent of the funds collected will be loaned to the national treasury.

In practice the new bill, if it is approved by the parliament, means greater possibilities for the citizens on the local level and through the parliament to influence and even prevent decisions to build.

The Central Association of Industries issued a comment saying that a new nuclear energy law is needed.

"On the other hand, there is no need for the fund for the disposal of nuclear waste which is being proposed," said a spokesman for the Central Association of Industries, managing director Krister Ahlstrom.

The industry would rather retain the funds for future waste disposal in its own accounts as reserves. At present the power industry has a total of about 750 million marks in reserve for disposal purposes.

"There is reason to suspect that with this proposed nuclear power fund they are striving for something besides management of waste disposal," claimed Ahlstrom.

Five Billion Marks

The two existing nuclear power producers will collect fully 5 billion marks while the units are in use. The power industry's share of that amount rose to 3.7 billion, since the industry does not send the used fuel to the Soviet Union, but has plans to eventually store it in the bedrock in Finland. The minister of trade and industry, Seppo Lindblom, said yesterday that 75 percent of the fund would in practice be loaned back to the industry which owns the nuclear power plants.

He considered it highly probable that the remaining 25 percent would be borrowed by the national treasury, since it is more advantageous to the state than to take out foreign loans.

The interest earned by the fund will be the basic interest paid by the Bank of Finland plus two percent and an inflation clause. The existing funds of 750 million marks will be transferred to the new fund. It will be managed by directors appointed by the government for 3 years. The Ministry of Trade and Industry will have overall supervision.

Compromise

The bill now before the parliament is the result of a struggle between Minister of Justice Christoffer Taxell and the government majority. Taxel wanted the fund to be administered by the industry.

Actually the two proposals are very much alike. Lindblom characterizes his own bill as a compromise in which the possibilities of control by society are greater, "a more democratic model."

In the government's internal negotiations the government majority, as a counterproposal to Taxell's bill, demanded that the state take more than 25 percent of the fund.

The industry would have had to be satisfied with at most 65 percent of the fund.

In a vote Taxell would hardly have been supported by other than his party colleague Gustav Bjorkstrand. But there was no vote, and instead there will be a government controlled fund with industry able to take 75 percent.

Approval

To a direct question about how the parties stand on the new bill, Lindblom said that his impression is that the Center Party, the Finnish Rural Party and the Social Democrats approve the principles.

The bill will probably run into opposition from the absolute opponents of nuclear power, who can read an implied approval for continued nuclear power in the text of the law.

The bill will be subjected to the constitutional process, which means that final approval will come at the earliest following the election in about two and one-half years. It could also take longer.

In case a decision on a fifth nuclear power plant must be made before the law is passed, the government can ask the parliament for approval or rejection in the same way as when deciding on the economic powers law. That also takes place in one transaction.

Local Approval

Before the parliament can exercise its absolute right of veto a nuclear project must pass through at least three preparatory stages.

First the nuclear power project must be approved by radiation and other safety authorities. They can stop it completely.

After the security process, the municipality of the planned site and the nearby municipalities must approve, and the citizens be heard.

In the third stage the question is decided upon in the government and passed on to the parliament.

"What happens if the municipalities do not approve a nuclear power plant in their area?"

Seppo Lindblom said that the right of self-determination of the municipalities in such a case can not be violated.

Contradictory

On certain points the bill is a bit contradictory.

On the one hand it is reasonable to bring the parliament in on the decision process before bids are invited and the detailed planning is completed, before the fundamental agreement is reached.

But that introduces the risk that all information is not yet available for a considered economically correct decision.

(Of course that also limits the economic freedom of action of the nuclear power company.)

In the second place the bill is based on a new concept of legislation; the interests of the community will be the basis of the parliamentary decision to reject or approve new nuclear power installations.

One can ask the question: according to which party's government or parliamentary majority will the interests of a community be evaluated from election to election?

Paper Backs Legislation Proposals

Helsinki HUFVUDSTADSBLADET in Swedish 24 Feb 85 p 2

[Editorial by Jan-Magnus Jansson: "Now it is the Nuclear Law's Turn"]

> [Text] The proposal for a new nuclear energy law which was presented on Friday is a very solid piece of work, and sympathetic in its striving for maximum security and a more democratic decision process, writes Jan-Magnus Jansson. This assumes however that in nuclear power there is an actual energy-political alternative.

Long awaited bills which have under preparation in the government for years will suddenly, one by one, begin to come before the parliament. The nuclear energy law has also appeared, after constitutional and preliminary study reforms.

The nuclear energy law replaces the atomic energy law of 1957. For years it has been said that the old law can not meet the demands of rapidly advancing technical developments, or the changed political situation. This despite the fact that it has several times been changed and supplemented.

The old atomic energy law saw nuclear power primarily as a technical problem. The formal decisions about new nuclear power plants were placed rather low in the hierarchy of national decisions by technical experts in the Ministry of Trade and Industry and the Radiation Safety Institute. In practice, however, the cabinet already has been involved in the more basic questions of the establishment of nuclear power plants.

As soon as nuclear power became primarily a political question the scenario changed entirely. It has now become completely decisive who will make the decision on the establishment of new nuclear power plants and according to what procedures that will happen. In addition there is the question of who will take charge of nuclear waste, which has reached reached much larger dimensions than before.

It must immediately be said about the proposal for new legislation that it is a very solid piece of work. Its basic ideology--attaining maximum security on the one hand, thorough consultation with the local population and clear adherence to democratic decisionmaking on the other--is also sympathetic. All this assumes, as we consistently have done here, that nuclear power is an energy-political alternative. If, on the other hand, one totally rejects

nuclear power, he is probably placed in a rather painful situation by the new proposal. As stated above, the bill reinforces popular influence on decisions concerning nuclear power, but on the other hand it assumes the possibility that new nuclear power plants will be established, and thus it goes against the principal opponents of nuclear power.

As for the decisionmaking process with the establishment of nuclear power plants, the bill has many important new points, especially in comparison with the letter of the existing law. What it does in practice is perhaps mainly to legalize and make precise something which would probably have come to the fore if the old law had remained in effect.

Thus the law divides the decision process on questions of nuclear power into two main parts. First there is the decision in principle which has political scope, then a more technical permission procedure.

The preparation of the decision in principle begins with a phase which is intended to give sufficient influence to the local population and the municipalities which are confronted with the eventual construction of a power plant. The inhabitants of the place and the neighboring municipalities will be given the opportunity to put forth in writing their views on the plans for the power plant in the beginning phase. That naturally assumes that the firm which has asked to construct a nuclear power plant has a sufficiently precise plan to present.

The right of municipal planning, which SFP [Swedish People's Party] has been especially anxious to protect, is clearly guaranteed in the text of the bill, as far as we can see. It says specifically that before the government makes its decision in principle it will confirm that the municipality where the power plant is planned to go has approved its construction. Thus a nuclear power plant can not be built against the wishes of the municipality.

According to the bill, a cabinet minister must not make his decision in principal "against the total interests of the community." The words are vague, but are clarified in the relationship between energy supplies, suitability of the location, environmental questions and the arrangement of fuel supplies and waste disposal.

An especially long-awaited element in the proposal is that parliament will make the final decision in principle on nuclear power plants. The parliament decides the issue with a simple majority, and can only say yes or no to the government's bill, not change it.

This puts the decision on the only organ which has sufficient democratic legitimacy to decide such a sensitive issue. If the government's proposal on the introduction of a referendum is approved, the parliament can possibly put the question to an advisory referendum. The responsibility for the decision will rest, however, with the members of parliament.

The permission procedure which then follows is obviously very important, but of a more technical nature. The existing organs, the Ministry of Trade and Industry and the Radiation Safety Institute, currently are in charge of it. It should be emphasized that technically expert organ, the Radiation Safety Institute, has during the years created a reputation for itself of accuracy and independence.

The other question which together with the decision process has caused the most confusion is the financing of waste disposal. The bill will solve the question by forming a national waste disposal fund which will be formed by the fees which the nuclear energy companies will pay in each year. The model for the administration of the waste management fund caused a long struggle in the government, in which Minister Taxell stood for the idea that the industries themselves should have control of the fund. In this way it would be guaranteed that the granting of credit from the fund would not serve other purposes than those of the power companies. Now, however, 75 percent of the fund will be reserved for the power companies or their stockholders, which will guarantee the same result for a rather long time. The remaining 25 percent can be borrowed by the state for use in the national budget, and one can expect that that possibility will not remain unused.

Because of subtleties in our constitution the bill must be dealt with in constitutional order, which means that a handful of MPs can vote it over until after the new election. It is probable that there is a sufficiently large number of opponents of nuclear power to prevent its approval soon, and it can be expected that the bill will cause an exceptionally powerful debate in parliament. If, however, the old law remains in effect for awhile, and if a fifth nuclear power plant should be of current interest in the meantime, the parliament will surely decide its fate. Minister Lindblom has several times repeated this promise, and it can be taken for granted that it will be fulfilled.

9287
CSO: 5100/2546

SPAIN

SYSTEMIC ANALYSIS OF COFRENTES NUCLEAR FACILITY

Madrid LUZ Y FUERZA in Spanish Sep-Oct 84 pp 5-11

[Excerpt] The Power Plant

[Text] The Cofrentes Nuclear Power Plant is located 2 kilometers from the town of Cofrentes in Valencia province, at the end of the Embarcaderos reservoir, on the right side of the Jucar River, very near its junction with the Cabriel.

The plant is located on a site near the river, about 40 meters above the median level of the Jucar River's waters (the end of the reservoir is 372 meters above sealevel). The area covered by the site is 300 hectares.

The closest towns are Cofrentes (to the north) and Jalance (to the south). Both are located on National Highway 330, which passes the reactor building at a distance of 1 kilometer, and which connects with the Madrid-Valencia Radial III in Requena, and to the south with the Madrid-Alicante National Highway in Almansa. By road, the distance to Valencia is 100 kilometers; it is 65 kilometers in a straight line.

The Cofrentes area has a low population density and rather limited agricultural resources. Industry is practically nonexistent, except for some hydroelectric developments. These factors, combined with its relative proximity to the major electrical energy consumption center of Valencia, spurred the selection of this location.

The plant will be equipped with a boiling water reactor built in the United States, of the BWR-6 type; it will have a gross electric power of 975 MW (930 MWe net power).

The plant's buildings are practically all located inside the restricted area, a circle with a radius of 750 meters, centered on the reactor's axis. For descriptive purposes, these buildings may be grouped into three major areas.

a. main buildings area
b. cooling services and liquid management area
c. open area

farther away are the solid waste storage facility and the stack used for discharging gases during normal operation; the water intake and liquid effluents discharge structures, the meteorological station, and the public information center are all located outside the restricted area.

The main buildings are grouped along a north-south alignment. These buildings are the turbine, auxiliary, reactor, and fuels buildings. Located to the east of these buildings are the auxiliary boilers, heaters, radioactive wastes, and diesel treatment facilities; to the west is the services and electrical building. Somewhat removed from the former group, though communicating with it to the southwest, are the shops/storage facilities and administration buildings.

Turbine Building

This is the largest building of the facility, with a floor area of 100 x 79.5 meters. It houses the turbine and generator, aligned along a north-south axis; the main condenser, into which the turbine's two low-pressure units discharge, and the two steam dryers/superheaters, as well as their main components. In addition, it also contains auxiliary equipment for these components.

This auxiliary equipment includes equipment for the treatment of gases removed from the condenser (offgas) which will afterwards be conducted, along with the ventilation gases discharged (HVAC) from the various buildings, to the atmospheric discharge stack. This is done by a common underground collector, running from north to south.

Auxiliary Building

This facility is located between the reactor and turbine buildings and is traversed by the steam tunnel, which forms part of this building. This tunnel is a rectangular structure made of reinforced concrete, which penetrates the reactor building up to the drywell and which contains the main steam pipes (four), the water supply pipes (two), and other process lines which link the reactor and the turbine area.

The lower level contains the pump rooms of the ECCS (Emergency Core Cooling System). The second level, located approximately at groundlevel of the plant, contains, in addition to access to the building, cable distribution rooms and extensive ducts linking it to the control room, located in the service building.

The rest of the building is occupied by other auxiliary and ventilation equipment.

Reactor Building

The reactor building, with a circular area 42 meters in diameter and 52 meters in maximum external height, is a seismic class I building designed to house the reactor and its major circuitry and auxiliary components. It has a pressure reduction system designed to absorb the energy released and to avoid the escape of fission products in the event of a design-based accident (an accident involving a loss of cooling capability).

It is surrounded on the north by the auxiliary building and on the south by the fuel building. Although the three buildings have independent functions, they form a unit called a "Mark III arrangement." This Mark III design or arrangement is a containment system featuring multiple barriers (drywell, primary containment, shielding-auxiliary-fuel buildings), designed to avoid leakages into the environment. To achieve this, the space between the last two barriers is constantly maintained at a pressure lower than that of the external atmosphere.

The reactor's container is located in the center of the building on a base. It is surrounded by a protective housing, and moving from the container toward the outside of the building we find the following layers arranged as successive housings:

a. The wall of the drywell (absolute design pressure: 3.1 Kg/cm^2). This, along with the upper metal lid, forms a tightly sealed enclosure, whose only outlet is through the pressure elimination pool.

b. The pressure elimination pool, with a ring-shaped space with water kept up to a level of 5.7 meters above the bottom (3,200 m^3 of water).

c. The metal containment, a steel cylinder 58.5 meters in height (51.4 meters above ground level), and 40 meters in diameter, topped by an ellipsoidal dome and designed to withstand an absolute internal pressure of 2.05 kg/cm^2.

d. The shielding building, a reinforced concrete cylinder concentric with the metal containment facility. A space or ring of 1.5 meters was left between both cylinders, which will be kept at a pressure lower than the atmospheric pressure at all times, so that, if an incident should occur, the external air would come in, thus avoiding leaks into the atmosphere.

e. Above the drywell are the upper fuel pools and the operating area for loading and unloading of the reactor. Above this area is the building's polar crane, with a capacity of 91 metric tons.

Fuel Building

This contains the installations and equipment needed to receive and store new fuel until it is loaded into the reactor.

It also has two large pools lined with stainless steel for underwater storage of fuel that has been irradiated and depleted in the reactor; these pools are separated by a third, much smaller pool, called the transfer pool. The transfer pipe's outlet is located here; it connects this building with the pools located inside the containment facility, above the level of the reactor's container. Through this pipe, new fuel elements are moved to the reactor, and spent fuels are removed from it.

The building contains systems and equipment needed to maintain the temperature and quality of the water in the pools and to control its internal atmosphere. Part E of this building contains the auxiliary filtration systems for use in normal operation, and the filtration equipment (two) of the SGTS (Secondary Gas Treatment System) used in emergency situations, which releases gases to the atmosphere through a seismic class I stack, which emerges from the roof of this building.

Finally, in Area S there is an access portal for trucks, providing entry to the level + 0.660 meters so that equipment can be brought into the containment facility. It is also used to receive both new and irradiated fuel containers.

Cooling Towers

The Cofrentes Nuclear Power Plant is cooled in a closed circuit through two natural draft towers, 130 meters in height and 90 meters in diameter at the base. The water coming from cooling the condensers of the main turbine is sent to the tower in a closed pipe, where it is cooled by being sprayed in a reverse current against the rising air. The water leaves the bottom or pool of the towers through an open channel going to the ciculation pumps building, of the open air type, where four propeller-driven pumps with a vertical shaft and 2,800 HP of unit power send a cooling flow volume of 28 m^3/s to the condensers, thus completing the circuit.

Technology

The boiling water reactor is a direct cycle system. This means that a single primary fluid or coolant is vaporized in the reactor or nuclear boiler, and the steam thus produced expands in the main turbine, which drives the electrical generator.

The nuclear steam generator is located inside the reactor's core, placed with its auxiliary and control elements inside a pressurized container. The fission of the uranium atoms takes place continuously inside the reactor's core, thus generating the energy required to convert the water into steam.

The fuel used is uranium slightly enriched with the U^{235} isotope, in the form of synthesized oxide (UO_2). This is a ceramic material capable of withstanding high temperatures and levels of radiation. It is contained in hollow rods made of zircaloy-2 (zirconium alloy) clustered together to form fuel elements that are easy to handle. The reactor's water flows upward though the core formed by the juxtaposition of fuel elements with the rods in a vertical position. In the Cofrentes Nuclear Power Plant, the zircaloy rods, heated by fission of the uranium nuclei they contain, generate approximately 1.5 metric tons of saturated steam per second. After separation from the liquid base and drying in the upper part of the reactor's container, this steam is expanded in the turbine, thus driving the electrical generator. Upon discharge from the low pressure turbines, the water vapor is condensed in the main condenser and is sent back to the reactor through a conventional regenerating cycle with degasification in the condenser, and demineralization of the condensate.

The reactor's power level is regulated by the reactor's circulation pumps and the control rods which penetrate the core through its lower part.

The uranium dioxide is practically not radioactive at all when it is new, but during the reactor's operation, active isotopes are created in it; these are known as fission products. The fuel's metallic zircaloy cladding ensures that these products will remain contained within the rods. Nonetheless, if the cladding were damaged, the fission products could escape from the fuel and appear in the primary coolant; they could then be carried along to the turbine and the condenser.

Furthermore, the steam generated in a boiling water reactor is always radioactive, even when there are no defects in the fuel cladding, since it contains gaseous activation products, elements that become radioactive upon being exposed to the intense radiation field present in the reactor's core. The most significant of these elements are: N-13, N-16, N-17, O-18, O-19, and F-18. The most active is N-16, even though it has a very short half-life (7 seconds). Nonetheless, despite these two facts--the presence of activation products and possibly, the presence of fission products in the coolant--the construction features of the primary circuit and the treatment systems for radioactive liquids and gases have kept the plant's discharges, and consequently, its impact on the environment, to a minimum. The Cofrentes Nuclear Power Plant, with a gross electric power of 975 MW, is equipped with a boiling water reactor of the BWR-6 type, designed and built in the United States by General Electric.

The reactor's core has 624 fuel elements which contain 114 metric tons of uranium enriched to a level of 1.7 percent with the U-235 isotope. Each fuel element, of the improved 8 x 8 type, is made up of 64 rods, approximately 1 cm in diameter and 3.80 meters in length, placed in a vertical position and anchored by two support structures or plates at both ends, plus seven intermediate spacers. Each element is then sheathed in a square

zircaloy-4 channel or socket. Two of the 64 rods that make up each fuel element are hollow, and cooling water circulates inside them; they are called water rods. The other 62 rods contain the synthesized uranium oxide (UO^2), in the form of pellets whose height is approximately equal to their diameter.

In addition to the fuel elements and the appropriate measurement instruments, the core contains 145 cruciform stainless steel control rods; these rods contain boron carbide enriched with the 3-10 isotope, used as a neutron absorbent material. The control rods penetrate the core from its lower part.

The reactor's core is housed inside the pressurized container, where it remains fixed in the appropriate position by means of the lower support plate and the upper guide or plate. It is cooled by forced convection by means of two motor-driven circulation pumps (2 x 400 HP) located outside the container, and a ring of 20 jet pumps, located in the periphery of the core, inside the reactor's container.

The reactor's pressurized container measures 21.8 meters in height and has an internal diameter of 5.5 meters. It is made of high-resistance, low-alloy carbon steel and was designed, manufactured, and tested in accordance with the ASME Code, Section III, Class I. The minimum thickness of the wall is 15.2 cm; its internal stainless steel lining is 5 mm thick. It weighs 608 metric tons (with the lid), which makes it the heaviest of the plant's components.

Safety

Safety as it is currently perceived and applied to nuclear reactors (the concept of extreme safety or "defense in depth") has two clear objectives:

1. To minimize the probability of an accident;

2. To minimize the consequences of such an accident, if one should occur.

This dual intention has led to three modes of action influencing the design, construction, and operation of modern nuclear power plants.

a. Incorporation of inherent safety measures in planning and design;

b. Observance of stringent quality control;

c. Incorporation of protective and safety systems in the plant.

By inherent safety, we mean the application of some design principles which, because of the very laws of nature itself--of physics in particular--avoid the occurrence of certain types of accidents. For example, the reactor's

core is designed so that its total power coefficient is negative. This means that, if the reactor's power levels begin to increase for any reason, there will be an instantaneous and spontaneous feedback process, which will brake this increase and will produce a decline in power.

In addition, stringent quality control is applied to all processes and products during the phases of planning, design, manufacturing, construction, and operation of the plant and of its equipment. For this purpose, the consulting engineers, contractors, and suppliers have had to establish special quality control organizations.

The most important function of the protective systems of a nuclear power plant is the immediate shutdown of the reactor (the halting of the nuclear chain reaction) in any abnormal situation; the startup of safety systems, and the prevention of errors during operation. These protective systems incorporate some very strict reliability conditions. In the Cofrentes plant, there are four signal measurement and transmission channels for each variable involved in safety control. To trigger a shutdown, there must be coincidence of at least two channels--two of four. Thus, a spurious signal in one channel will not cause an undesired shutdown, for lack of this coincidence.

In addition to the reactor's auxiliary systems, needed to facilitate normal operation, and the auxiliary backup system for use in abnormal operating situations, light water reactors are required to be equipped with the safety systems necessary to avoid the risk of an escape of radioactive products into the environment, in the event of breakage of one of the reactor's large pipes. To prevent such accidents, entailing a loss of coolant, water reactors are housed in special containment buildings, and equipped with emergency core cooling systems.

The purpose of containment and its related elements (pressure elimination pool, sprinklers, insulation valves for transfer pipes, etc.) is to ensure that the steam and water escaping from the reactor's container in the event of breakage of a pipe will remain inside the containment structure. If the break occurs outside the containment area, insulation valves of the pipe will be closed to avoid the escape of water (or steam) from the reactor's container to an area outside the containment through this break.

The purpose of what is commonly called the ECCS (Emergency Core Cooling System) is to continue cooling the core if the normal cooling system, that is, the water that circulates inside the reactor's container, should fail. These systems are designed to avoid excessive heating and to protect the reactor's core in emergency situations that could cause damage to the cladding of the fuel rods and lead to the escape of fission products. During design, attention is given to the possibility of the breakage of any pipe present within the containment structure.

The ECCS includes the following systems:

1. HPCS: High Pressure Core Spray;

2. Reactor ADS: Automatic Depressurization System;

3. LPCS: Low Pressure Core Spray;

4. Reactor RHR: Residual Heat Removal system, in its function as a low pressure coolant injection in the container; LPCI: Low Pressure Core Injection.

It is designed to perform the following functions:

a. To avoid the breakage of fuel claddings in the event of an accident entailing a loss of coolant;

b. To provide this protection by means of at least two independent cooling systems which are activated automatically;

c. To operate with or without energy supply sources external to the plant (backup with diesel generators);

d. To provide this protection during long periods and with reliable cooling water sources, with the capacity to dissipate the heat extracted from the core for 30 days by using, if necessary, the essential services water tank as a final cooling tank for the plant's heat;

e. To permit the testing of all of its systems by efficient methods, including testing of some components, while the plant is in operation.

ECCS operation is activated automatically by the reactor's protection system in the presence of redundant signals indicating a low water level in the reactor's container, or high pressure in the drywell atmosphere, or a combination of both of these situations.

The Information Building

The information building is an important feature of the Cofrentes Nuclear Power Plant. Occupying facilities adjacent to the plant itself, it has a number of rooms in which visitors can be shown simply and clearly how the plant functions, by means of highly informative moving panels.

The explanations of the personnel responsible for this center are quite comprehensible and demonstrate a high level of preparation, in order to use simple, nontechnical language for many explanations which, given their scientific complexity, could require a lengthy dissertation.

The thousands of people who have visited this center have left it with the feeling that they had gained a further understanding of nuclear energy.

Initiatives such as the information center of the Cofrentes Nuclear Power Plant are essential if the dissemination of information on this clean energy source, which is vital for the progress of humanity, is not to be left solely to the criticisms of persons who, because of limited knowledge, lack of interest, or simple ignorance, might tend to reject it in a reflexive and not carefully thought out manner.

The merits of this information center are due in the first place to the promoters of this concept, and secondly to all those persons who, with their dedication and enthusiasm, are bringing to the general public a knowledge of nuclear energy and of the benefits that the facilities of the Cofrentes Nuclear Power Plant can offer Spain.

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SPAIN

TECHNICAL OVERVIEW OF VANDELLOS II CONSTRUCTION

Madrid LUZ Y FUERZA in Spanish Sep-Oct 84 pp 13-18

[Text] The Vandellos II Nuclear Power Plant has just been added to the nuclear energy production network of the Catalan autonomous district. During the initial phase, this area was served by the Vandellos I and Asco I nuclear power plants (first and second generation, respectively). When these plants first became operational, they provided coverage of much of the entire region's energy demand.

Chronologically, this plant belongs to the group of what is termed "third generation plants": that is, those which came at the end of the vital nuclear program conducted in the 1960s and early 1970s. Consequently, it incorporates the latest and most advanced technology.

The advanced nature of its design has been recognized internationally. Because of the innovations and carefully planned features it incorporates, it has served as a "reference plant" in a number of bids issued abroad.

As a summary of earlier reports published on this nuclear power plant, in this article we are providing a brief overview of its site, general features, and civil engineering. In order to avoid undue repetition, we will omit any more detailed explanations of the various components, though we will discuss at greater length one of the most important aspects of its development: its safety systems. These systems were designed to meet the most stringent requirements; because of their redundancy and high level of reliability, Vandellos II has earned a reputation as a model of protection from the risks inherent in its activities.

The Plant

The Vandellos II Nuclear Power Plant is located on the shore of the Mediterranean, about 40 kilometers south of Tarragona, between Highway A-7 and the sea, in the Lleria Gulch and Malaset area. The closest urbanized area is the city of Hospitalet del Infante, located approximately 6.5 kilometers northeast of the site.

The facility will be equipped with a pressurized light water nuclear boiler, whose nominal power will be 2,785 MW of thermal energy. It will power a turboalternator unit with a gross power of 982 MWe. It will have three cooling circuits; its fuel will be slightly enriched uranium dioxide. It will also incorporate auxiliary systems and technological safeguards.

Construction of this plant is scheduled to be completed in 1987.

The annual estimated electricity production by this plant will be about 5.5 billion kWh, with 1 month allowed each year for a scheduled shutdown to replace spent fuel.

The plant has received its construction permit, granted by the ministry of industry and energy on 29 December 1980. It was declared a project which will benefit the public on 9 May 1981, and has received the appropriate licenses from the town of Vandellos.

Over 4,000 people have been involved in the construction of the plant. It was necessary to remove approximately 1,300,000 m^3 of rocks and soil, to pour about 190,000 m^3 of reinforced concrete--using about 27,000 tons of steel for reinforcement--and to lay about 70 km of pipes and approximately 2,200 km of electrical cables.

National participation in the plant's construction will be over 80 percent.

Characteristics of the Nuclear Equipment

Reactor

a. Design: Westinghouse
b. Type: PWR (Pressurized Water Reactor)
c. Fuel: enriched uranium dioxide (UO_2)
d. Control rods: boron carbide, silver, indium, cadmium
e. Number of fuel assemblies: 157
f. Number of rods in each fuel assembly: 264
g. Total number of fuel rods: 41,448
h. Average enrichment of initial fuel (percentage of weight): 2.1; 2.6; 3.1
i. Average enrichment of reloaded fuel (percentage of weight): 3.04
j. Material used for cladding: Zircaloy-4
k. Total weight of UO_2: 75,343 kilograms
l. Density of average lineal power in the core (nominal power): 17.88 Kw/m
m. Average specific power (nominal power): 41.8 Kw/KgU
n. Scheduled refueling frequency: 12 months
o. Part of fuel removed from core: 33.3 percent

The reactor is controlled by means of:

a. Movement of control rods
b. Variation of the boron content dissolved in the coolant

Material used for the motor's container:

a. Basic: carbon steel
b. Lining: austenitic stainless steel

Manufacturer of reactor's container: ENSA (Santander)

Steam Generator

a. Generator: Type F
b. Design: Westinghouse
c. Manufacturer: ENSA (Santander)
d. Model: F
e. Number: three
f. Moisture content of steam produced: 0.25 percent
g. Flow: 5,813 t/h
h. Temperature: 226°C

Reactor Coolant Pumps

a. Design: Westinghouse
b. Pump manufacturer: Westinghouse Electro-Mechanical Division, Cheswick, PA.
c. Motor: Westinghouse-Erandio
d. Model: 100-D
e. Type: Single-stage centrifuge
f. Number: three
g. Volume of flow: 6.5 m^3/s

Characteristics of Conventional Equipment

Turbogenerator

a. Design: Westinghouse
b. Manufacturer: Westinghouse-Bazan National Enterprise (El Ferrol plant)
c. Type: TC 6F
d. Low pressure final stage blade length: 111.76 cm
e. Number of casings: one high pressure, and three low pressure
f. Velocity: 1,500 revolutions per minute
g. Power: 982,028 kW
h. Generating power: 1,092 MVA
i. Power factor: 0.9
j. Voltage: 21 kV

Turbine Cycle

a. Number of superheated stages: two
b. Number of condensate heating stages: six
c. Heaters drainage system: backpumping
d. Heaters in the neck of condenser: numbers 1, 2, 3, and 4

Condenser

a. Type: single pressure
b. Number of pipes: 77,994
c. Pipe material: titanium
d. Absolute pressure: 50.8 mm Hg
e. Condensate flow: 3,718 t/h
f. Volume of flow of cooling water: 48.5 m^3/s

Characteristics of Steam Cycle of Shutdown Valves

a. Flow: 5,545 t/h
b. Absolute pressure: 65.66 kg/cm^3
c. Temperature: 282.3°C
d. Enthalpy (heat content): 662 kcal/kg
e. Moisture content: 0.25 percent

The Vandellos II power plant offers a broad prospect of a group of buildings, in which one main building with a wide dome about 40 meters in diameter dominates the others.

This tall dominant building is known as the Containment Building. It houses the reactor and the reactor's cooling system. Its main purpose is to control the release of radioactivity from the reactor's cooling system in the unlikely event of an accident involving a loss of coolant. The containment building provides biological shielding during normal operation and also serves as a barrier against external risks in case of an accident.

The second tallest building in the Vandellos II nuclear complex is the Auxiliary and Control Building. This building has two parts. One is the auxiliary part of the building that houses the mechanical and electrical equipment required for shutdown of the reactor without risk. It also provides biological shielding around radioactive equipment, both for the operating personnel and for maintenance. The other part of the building houses necessary support systems that are directly related to the plant's safety. From a functional point of view, these essential elements are: the control room, the upper and lower cable rooms, the electrical equipment and batteries room, and the air conditioning equipment related to the plant's safety.

The third building is the Fuel Building. It contains the facilities necessary for the handling and storage of both new and irradiated fuels. It has a reinforced concrete pool for underwater storage of irradiated fuel, and another for the wet storage of new fuel.

The fourth building at Vandellos II is the Diesel Generators Building. These generators are identical and are separated from each other. They are used to provide backup power, in order to operate certain equipment in case of emergency.

The fifth building is the Turbine Building, which houses the turbine, the generator, the condensers, the condenser and water supply system, as well as the appropriate electrical and mechanical equipment. This building also contains all the necessary auxiliary equipment, such as compressors, demineralizers, etc, and the ducts for cables and pipes.

Finally, there is the Radioactive Wastes Building. It houses the systems used for the treatment of the liquid, solid, and gaseous radioactive wastes generated at the plant.

I have here the report provided by Mr Estape Arnau, pointing out the essential safety features included in the project, and specific elements of some of the most important components.

"The position of the plant's buildings follows the rational arrangement of the SNUPPS projects in the United States; this arrangement is designed to incorporate the experience acquired in highly advanced nuclear power plants."

"Repairs and independence between different pieces of equipment, the Waste Treatment Building, and the Technical Support Center incorporate innovative advances in relation to earlier designs."

"The plant was designed to produce electricity in a safe and reliable manner. The design was prepared in accordance with all applicable codes, standards, and regulations."

"The facility was planned so that, during its operation, discharges of radioactive materials into the environment will be limited to values lower than the limits established in the applicable regulations, both during normal operation as well as in abnormal events, or in design-based accidents."

"The seismic criteria used in the design include planned soil accelerations of 0.1 g for earthquakes during operations, and 0.2 g for earthquakes during a system shutdown."

"The NSSS (Nuclear Steam Supply System) consists of a pressurized water reactor, its cooling system, and auxiliary associated systems. The RCS (Reactor Cooling System) consists of three closed cooling circuits connected in parallel to the reactor's container. Each circuit contains an RCP (Reactor Coolant Pump) and an SG (Steam Generator). A pressurizer with electric heating is connected to the hot section of one of the circuits."

"The reactor's core is formed of uranium dioxide pellets contained in pressurized zircaloy rods with their ends sealed with welded plugs. The rods are grouped in assemblies using a grid structure, provided with springs. Each of these assemblies forms one fuel element."

"The core is of the multiregions type. All the fuel elements are mechanically identical, though the fuel enrichment is not the same in all the elements."

"Typically, during the initial fuel loading, three different enrichment levels are used. The fuel elements with the highest enrichment are placed in the peripheral region, or the external region, and the other two groups of new enriched elements are placed in the central region, according to a previously selected framework."

"In subsequent refuelings, a third of the fuel is extracted and new fuel is placed in the external area of the core. The rest of the fuel is distributed in the central two-thirds of the core, so that the distribution will provide optimum power."

"To control the reactor, assemblies of control bar clusters, composed of absorbent rods, are used. These absorbent rods are made of boron carbide (B_4C) and silver, indium, and cadmium. As clusters, they are moved inside the zircaloy guide tubes in some of the fuel elements. Above the core each cluster of absorbent bars is attached to a yoke connector and a drive shaft, which is raised or lowered by means of a drive mechanism placed in the lid of the reactor's container."

"The cladding of the fuel rods is designed to maintain their integrity throughout the life of the fuel. The fission gases discharged inside the rod and other factors affecting the design life are taken into account for the maximum expected exposure. The reaction and control systems are designed so that any release of xenon will be properly absorbed. Assuming that the proper chemical mix is obtained (for example: a suitable concentration of boric acid in the coolant), the assemblies of control bar clusters (Reactor Control Clusters) can keep the core subcritical in zero power conditions, with a sufficient margin after a discharge, even with the most reactive RCCA (Reactor Control Clusters) locked in a totally withdrawn position."

"The reactor and its protective systems are designed to handle any anticipated operational events safely. The container and the reactor's internal elements house and support the control and fuel rods. The container is cylindrical with a semispherical lid and is covered inside with stainless steel. The pressurizer is a vertical cylindrical container with a semispherical lid; it is equipped with electric heating and spraying nozzles to control the system's pressure."

"The steam generators are vertical heat exchangers made of U-shaped tubes that use Inconel pipes. Inside, the moisture separation equipment reduces the steam's moisture content in the output nozzle to 0.25 percent of its weight or less, under design load and grade conditions. The water intake comes through a distribution ring with the aid of J-pipes located in the upper part of the steam generator, so that the water is distributed downward by sprinkling. This helps to avoid some of the problems that have occurred in earlier projects."

"The ESF (Technological Safeguard Systems) directly mitigate the consequences of hypothetical accidents up to and including a break--shearing--of the largest pipe of the pressurized barrier of the reactor's coolant. The safeguard system has sufficient redundancy and independence of components and supply sources, so that under the hypothetical accident conditions, the following will happen:

a. Coolant will be supplied to the core to limit thermal discharges in the core, to prevent excessive metal-water reactions, and keep the core in a configuration that will allow it to be cooled;

b. The integrity of the containment structure will be maintained;

c. Levels of radiation to the public will be kept under the criteria of 10CFR100."

"The main function of the containment structure is to control radioactivity leaks that might occur in the unlikely case of an accident entailing a loss of the reactor's coolant. Also, it provides a barrier against discharges of the reactor's coolant to the exterior, as well as a barrier against projectiles that might come from the outside. The necessary means have been provided to carry out both integrated tests of leaks from the building, as well as tests for leaks allowing entry into the building by different forms of external penetration."

A Worthwhile Investment

Construction of this nuclear power plant has maintained essential continuity in the investment plans which are providing such a high degree of development for the people of Tarragona. The economic coverage provided by the

ongoing investments in these projects, and in general, all of this constructive activity, has culminated with the completion of this project, which has provided a source of work for manufacturers of equipment goods, the harnessing of energy resources for the area, and a source of economic wellbeing for the region's inhabitants.

We should mention here that, thanks to the investment programs of the electricity companies, it has been possible to maintain continuity in the workloads of the engineering firms and of the companies that manufacture equipment. Such continuity will be shattered if future plans for building new nuclear power plants are halted.

Let's hope that will not happen.

7679
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SPAIN

SURVEY OF GERMAN-ENGINEERED TRILLO NUCLEAR PLANT

Madrid LUZ Y FUERZA in Spanish Sep-Oct 84 pp 21-24

[Text] Work on the Trillo nuclear power plant is moving ahead on schedule. Construction should be completed within the projected timeframe. Huge metal components have been hauled over the local roads, on their way to installation by Spanish engineers and technicians in their appropriate sites, thus giving shape to a project which has required a huge investment, one which will provide a considerable benefit for the region and for the nation as a whole.

Construction of this nuclear power plant will save the Spanish treasury an extraordinary amount of foreign currency that would have had to be spent on oil imports; it will also place us in a position to meet our growing energy needs during the coming years, in an excellent position of viability and independence.

The construction work is continuing at a good pace; we should note that a short time ago many of the plant's major parts and components were delivered. For example, in August 1984 the plant received the water supply tank, considered the largest piece of those scheduled for this construction. This unit, which is 30 meters long, was manufactured in the Boetticher and Navarro factory in Villaverde (Madrid).

The water supply tank will be placed in a horizontal position in the turbine operating area. The fundamental purpose of this tank will be to eliminate uncondensed gases and to take in steam for heating and maintenance of pressure.

Later some of the components of the main transformer were shipped to the plant from their place of manufacture, Cordoba. This is essential equipment for the plant's electrical system. It is designed to adapt the voltage of the electricity generated so it can be transmitted. To do this, the voltage will be raised from 21,000 volts to 400,000 volts, through three single-phase units, plus one reserve unit.

Continuing without interruption at the scheduled pace, the construction of the Trillo Nuclear Power Plant advanced one step further last October, when the Trillo I unit received its steam generators, or heat exchangers, from Maliano (Cantabria), where they were manufactured. Like some of the other large items, such as the reactor's container, they were shipped by sea from Cantabria to Alicante; from there to Trillo, they were carried on a platform hauled by two large trucks. The total length of this equipment is somewhat over 56 meters. They are 7.20 meters high, and 6 meters wide. The weight of each of the three generators to be used in the Trillo I plant is 440 tons.

The generators are evaporators with their framework placed in a vertical position. Inside they contain a cluster of U-shaped stainless steel pipes with a small diameter. The water coming from the reactor's container circulates through these pipes. This cluster of pipes is covered by cooler water on the outside. The dual purpose of these generators is to transmit the heat produced by the hot water that flows inside the cluster of pipes to the cooler water surrounding them, until this water is converted into steam capable of driving the turbine's blades, as happens in thermal power plants using coal or oil. Then the cold water that covers this cluster of pipes carries the coolant to the pipes, and returns the water circulating inside--cooler--back to the reactor's container, thus completing the temperature transfer cycle. The heat exchangers are equipment in which a separation barrier is established between the primary circuit, or the pressurized water, and the secondary circuit, or water/steam circuit.

The Plant's Safety Features

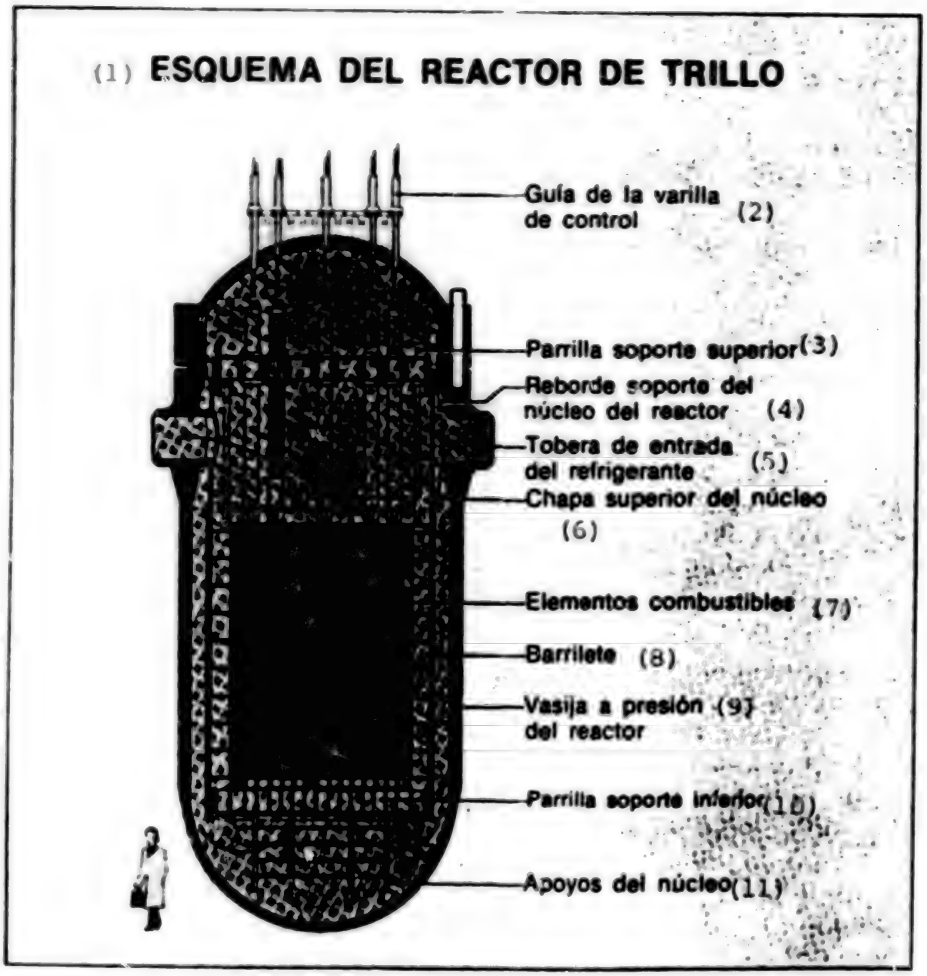
Maintenance of high safety standards at all levels is a primordial objective of the people responsible for the Trillo I Nuclear Power Plant. This demands a major effort, as roughly a third of the investment required for construction of a plant of this type is spent for safety systems. The administration now maintains constant supervision of the construction of the plant, as it will in the future monitor the plant's operation, thus helping to ensure maximum compliance with the safety regulations in force.

There are three fundamental principles ensuring safety at the Trillo plant:

a. Integrity of the series of barriers separating radioactive elements from the outside environment;

b. Continued cooling of the fuel if any of the various possible accidents should occur, by means of an effective safeguard system;

c. Use of components whose good operation has been proven by being in use in other plants without causing problems.



Key:

1. Schematic of Trillo Reactor
2. Control rod guide
3. Upper support grate
4. Edge of support for reactor's core
5. Coolant intake nozzle
6. Upper core plate
7. Fuel elements
8. Clamp
9. Reactor's pressurized container
10. Lower support grate
11. Core supports

Protective Barrier

Three enclosures are provided to guard against a hypothetical external leak both of radiation and of radioactive products, ensuring that a break in one of these barriers will be offset by the barrier containing it. For this reason, these barriers are designed to meet highly stringent criteria.

The first protective barrier is provided by the rods that house the fuel; the second by the container of the reactor itself and the concrete lid surrounding it; and the third is the spherical containment structure made of steel.

Safeguards

The safeguards ensure that the reactor will be kept permanently cooled. In normal operation, the cooling is done by the water circulating in the primary circuit. If for any reason problems or anomalies should occur during the normal functioning of this circuit, the emergency cooling circuit would begin to operate to cool the fuel during the length of time required to reach a cold shutdown stage, thus preventing the heat produced in the core from causing a meltdown. To make sure this system will work, all the vital equipment is installed with up to a fourfold redundancy, in order to deal with the worst possible case.

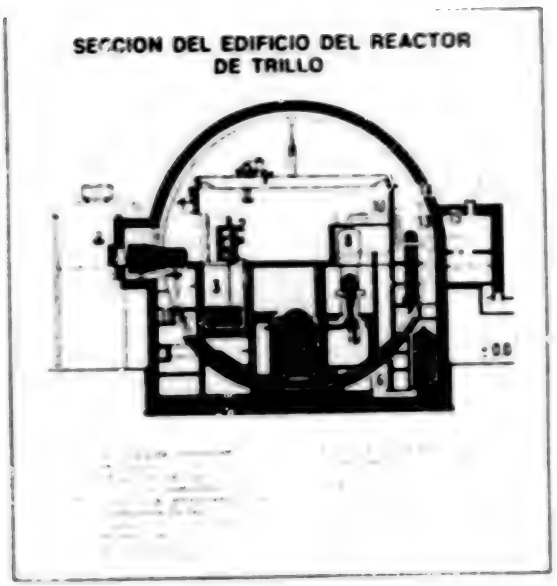
A series of heat exchangers, pumps and tanks, ventilation and filtration equipment, etc., provides the ability to control any emergency that might arise.

Use of Well Tested Components

The components and systems used in the Trillo I plant comply scrupulously with the international quality standards endorsed by the IAEA [International Atomic Energy Agency], with headquarters in Vienna, which is a U.N. agency.

These components and systems have also proven their worth: this means that similar components are functioning satisfactorily in other plants. The Trillo plant was designed using another plant with similar characteristics as a reference. This is the Neckarwestheim plant, which has been in operation in Germany since 1976.

These plants are subject to inspection by the Spanish government acting through the Nuclear Safety Council, to inspection by the manufacturer and the owner of the plant, according to very stringent control procedures. The entire design, manufacture, construction, and test procedure is documented and is kept on file.



Cross Section of Trillo Reactor Building

Key:

1. Lock used for introduction of equipment
2. Reloading machine
3. Pool for new fuel
4. Spent fuel storage support
5. Reactor's pressurized container
6. RHR pump
7. Biological shielding
8. Steam generator
9. Reactor coolant pump
10. Main steam pipe
11. Battery
12. Reloading water tank
13. Steel containment
14. Reinforced concrete lining
15. [illegible] steam valve

Cooling and the Environment

The steam leaving the turbine has to be condensed before being returned to the steam generators. This operation is done by a condenser, inside which water from a third cooling circuit circulates. This circuit, which may be either open or closed, is a closed circuit in the Trillo I plant.

In an open circuit, water is taken from a river; it goes to the condenser and is again returned to the river. In a closed circuit, as is the case at the Trillo I plant, the water that goes into the condenser is taken to two

cooling towers, where it is cooled, and is then recirculated again to the condenser. In this instance, the quantity of water taken from the river is much smaller: just the amount needed to replace the water that evaporates in the cooling towers.

The water that the Trillo I plant will return to the Tajo River will not be very hot: the temperature increase will be under 3°C, the temperature increment universally accepted as harmless in normal cases, and less than the natural temperature variation of this river between winter and summer.

The two cooling towers that will be used to cool the water from the plant's third circuit are 154 meters high, with a diameter of 110 meters at the base. Their operation is quite simple: the hot water coming from the condenser falls in fine streams from the upper part, meeting a rising current of cold air coming from the base, thus lowering the water's temperature. This cooling action is also enhanced by another factor, as a small part of the hot water evaporates, which cools the hot water even more. It is well known that the evaporation of a liquid produces cold.

The two Trillo I towers are of the natural draft type. The air penetrating the tower from the base rises naturally inside the tower, making use of the temperature differential between the base and the upper part. The draft produced is similar to that in a chimney.

The plume produced in the cooling towers is strictly and exclusively water vapor; there is no pollution or contamination at all, due to the tight seal of the plant's three circuits.

It may be safely assumed that nuclear power plants are the only facilities that measure their impact on the environment and know its consequences. For this reason, we can say that to date there is no definite evidence of any case of persons affected by illnesses caused by radiation in the vicinity of a nuclear power plant.

And this is true, even after 30 years of experience with nuclear power plants.

The same can not be said of other activities whose effects are not known in such detail, because they are neither measured nor studied in such an exhaustive manner. For example, we don't know the effects of the exhaust of cars, nor the effects of many medications, nor that of chemicals added to many foods, nor that of fertilizers and pesticides used in farming.

Radiation from the Trillo Plant Will Be Insignificant

Radiation from the Trillo plant will have no appreciable impact on people, water, agriculture and livestock in the area.

A person who drank only water from the plant's drainage pipe would receive a maximum radiation dose of 0.00043 millirem. This level is much lower than that of many natural and mineral waters. Its effect on agriculture is zero. As an interesting note, we will mention that a person spending 24 hours a day just outside the fence of the plant, who ingested 2.2 liters of water a day taken just a few meters from the plant's discharge pipe, and who ate fish from the river, milk and meat or agricultural produce harvested in the area, would receive a radiation dose of about 5 millirem a year. The dose coming from the natural radiation in the area (the sun, rocks, etc.) is between 100 and 120 millirem a year.

Electricity Production

Aside from the natural differences in scale between a nuclear power plant like Trillo I and thermal plants, both the design and functioning of the electrical components and the process of obtaining electricity are relatively similar.

The turbine of the Trillo I plant consists of a high-pressure unit and three low-pressure double-flow units, linked to the electric generator and the exciter by a single shaft.

The electric generator, operated directly by the turbine, generates a voltage of 27 kV with an actual power of 1,041 MW and a cos o = 0.9. It is bipolar and will generate a three-phase current at a frequency of 50 Hz.

The plant has two outdoor transformer units, one of 400 kV for the external distribution of the energy generated by the plant, and the other of 132 kV, used as an auxiliary power supply for the plant.

The plant is started up by feeding its own services from the 400 kV system, through the main transformer, with an open generating switch. The voltage generated, 27 kV, is raised to 400 kV by a bank of transformers consisting of three single-phase transformers. The purpose of this stepped-up voltage is to minimize transmission losses, since the higher the voltage, the lower the transmission losses, as the higher the voltage, the lower the losses in the phase when it is being stepped down for supply to the consumer.

The 400 kV system has a two-bar and 1 and 1/2 switch arrangement. It has four output lines and will provide electricity to the Loeches and Aragon power lines.

Summary

In closing, we should note that German technology was used for the construction of the Trillo Nuclear Power Plant; this was the first time German technology has been used for this purpose in Spain. This technology

is the property of KWU, and has been used to build other plants all over the world. Some of these plants have been operating for over 25 years without any major difficulties, and with a high level of efficiency. This record places this KWU technology among the best in the world.

This technology is different from what has already been used in Spanish PWR [Pressurized Water Reactors] and BWR [Boiling Water Reactors] plants. It is what Brazil selected for the massive construction of its nuclear power plants, thus starting an ambitious nuclear plant construction program.

But it has not been used solely in Brazil; there are also other similar plants, or plants with only slight differences, in Germany, the Middle East, Argentina, etc. To give an idea of the expansion of this technology, we will indicate that KWU has built or has on order over 30 nuclear power plants all over the world. It also supplies the first batch of fuel elements for the core of these plants, and will provide the largest part of future batches of fuel for its plants.

As has already been indicated earlier, construction of the Trillo Nuclear Power Plant will mean an enormous step forward toward energy independence for Spain, which our nation greatly needs for our economy and for the well-being of our people.

Technical Data

Power

Reactor's thermal power	3,010 MW (th)
Steam generator's thermal power	3,027 MW (th)
Gross electric power	1,041 MW (e)

Reactor's Core

Diameter of core (equivalent)	3,453 mm
Height of core (actual)	3,400 mm
Total weight of uranium (initial fuel load in the core)	93,901 kilograms
Levels of enrichment (initial fuel load in the core)	3.2%, 2.5%, and 1.9% weight of U 235

Fuel Elements

Number of fuel elements	177
Total length	4,185 mm
Weight of one fuel element	730 kilograms
Fuel	UO_2

Number of rods	236
Cladding material	Zircaloy 4
External diameter of cladding	10.75 mm
Internal diameter of cladding	9.3 mm
Diameter of pellet	9.11 mm
Control Rod Assemblies	
Number of control assemblies	52
Number of control rods in one assembly	20
Length of absorbent material	3,259 mm
Reactor's Cooling System	
Number of cooling circuits	3
Total flow volume of cooling medium	15,875 kg/s
Temperature at reactor intake	292.9°C
Temperature at reactor output	325.7°C
Service pressure	158 bar
Reactor's Pressure Container	
Internal diameter	4,878 mm
Wall thickness	245 mm
Total height	11,039 mm
Design pressure	176 bar
Design temperature	350°C
Net weight (without internal components)	429,000 kilograms
Steel Containment	
Diameter	53 m
Wall thickness	38 mm
Design pressure	5.3 bar
Design temperature	145°C
Turbine	
Steam condensation turbine, with high pressure unit and three low pressure double-flow units	
Rotation speed	3,000 rpm
Principal steam pressure at turbine intake	68.6 bar

Alternator

Actual power	1,041 MWe
Power factor	0.9
Frequency	50 cycles per second
Voltage at terminals	27 kV

Biological Effects of Radiation

Dosage (millirems)	Effects
25,000	No clinical effects. Detectable solely by special analyses.
50,000	Slight changes in blood composition. No other effects observed.
100,000	Nausea and fatigue.
200,000	Same effects, but more pronounced.
300,000	Nausea and vomiting. 20 percent die within 1 month. Recovery of the rest within 3 months.
400,000	50 percent die the first month.
600,000	Death practically a certainty.

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